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THE RIGHT HONOURABLE

SIR HENRY ENFIELD ROSCOE

P.C., D.C.L., F.R.S.

Photo. E. H. Mills. Walker Potts & Co.

Henry E. Roscoe

The Right Honourable

Henry Enfield Roscoe

P.C., D.C.L., F.R.S.

A BIOGRAPHICAL SKETCH

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BY

SIR EDWARD THORPE, C.B., F.R.S.

LONGMANS, GREEN AND CO.
39 PATERNOSTER ROW, LONDON
FOURTH AVENUE & 30TH STREET, NEW YORK
BOMBAY, CALCUTTA, AND MADRAS
1916

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sketch of the life and activities of Sir Henry
ld Roscoe is based, to a large extent, upon
bituary notice prepared at the request of the
ncils of the Royal and Chemical Societies, of
h its subject was a distinguished member, with
w to publication in their respective *Proceedings*
Transactions. In its present more extended
it is offered to a wider public as the record
a life in civic action worn," and as a slight
te from a grateful pupil, an attached co-worker,
a lifelong friend to the memory of a strenuous
minded man, of large aims and generous im-
s, who spent his abilities and energies un-
ngly in promoting the welfare of science and
good of his kind.

CONTENTS

CHAPTER I

PAGE

ROSCOE—HENRY ROSCOE 1

CHAPTER II

ENFIELD ROSCOE—BIRTH AND EDUCATION . . 16

CHAPTER III

OLLEGE, MANCHESTER 28

CHAPTER IV

KSHIRE COLLEGE 53

CHAPTER V

TORIA UNIVERSITY 77

CHAPTER VI

AS A TEACHER 97

CHAPTER VII

AS AN INVESTIGATOR 110

CHAPTER VIII

AND CHEMICAL LITERATURE 138

Contents

CHAPTER IX

ROSCOE AND THE ORGANIZATION OF SCIENTIFIC SOCIETIES PAGE 146

CHAPTER X

PUBLIC SERVICES—POLITICAL AND PROFESSIONAL WORK . 152

CHAPTER XI

UNIVERSITY OF LONDON—ETON COLLEGE—UNIVERSITY COLLI
OF DUNDEE—SCOTTISH UNIVERSITIES COMMISSION—RO'
COMMISSION OF THE 1851 EXHIBITION—CARNEGIE TRU
SCOTTISH UNIVERSITIES—SCIENCE AND ART DEPARTMEI
SCIENCE MUSEUMS—LISTER INSTITUTE OF PREVENT'
MEDICINE . . . . . .

CHAPTER XII

DIGNITIES AND HONOURS—THE *DEUTSCHE REVUE*—GERM.
AND ENGLAND—WORLD SUPREMACY OR WAR

CHAPTER XIII

HOME LIFE—LADY ROSCOE—WOODCOTE LODGE—PERSC AL
CHARACTERISTICS—DEATH 190

INDEX 204

THE RIGHT HONOURABLE SIR HENRY ENFIELD ROSCOE

CHAPTER I

WILLIAM ROSCOE—HENRY ROSCOE

THE subject of this memoir had no particular pride of ancestry. *Stemmata quid faciunt?* Although with no convictions on the subject, he was willing to believe that his line stretched at least as far back as Adam and Eve, and he doubted whether any man could with certainty claim—*pace* Darwin—a more ancient lineage.[1]

As he has told us in his Autobiography, his family was one of the many that could not trace its origin for more than three or four generations back. All he knew was that he came of a North-country stock, members of which—village Hampdens and mute inglorious Miltons—had been settled in the County Palatine and in the vicinity of Liverpool for many years. He had a distinguished grandfather, a man of mark and public weight in his native town, and

[1] Johnnie Carnegie lais heer,
Descendit of Adam and Eve;
Gif ony con gang hieher,
Ise willing give him leve.

who bears an honoured name in our literature. Of him it is related that when a certain Garter Principal King-at-Arms desired to trace his pedigree (which had hitherto baffled his researches), he replied that he was a good patriarch, and the proper person to begin a family, as he had a quiverful of sons. "Accordingly the whole descent is registered, and the Roscoes may now go on *in sæcula sæculorum.* Amen."

Mr. William Roscoe—Grandfather Roscoe as he was called in the family circle—was justly claimed by his grandson to be the first man of distinction that Liverpool had produced. Although more than one hundred and fifty years have passed since his birth his name still remains one of the most prominent in its history. His story is one of the Romances of Literature.

Born in 1753, he was the son of a market gardener who kept a bowling-green, attached to a tavern, in what was then a rural district of Liverpool known as Mount Pleasant. He learned to read and write, and that was practically all the schooling he received, for at the age of twelve he was required to help his father in the cultivation of his garden, and to carry cabbages and potatoes on his head to market. But he had an insatiable appetite for knowledge, and such leisure as he could secure he gave to reading and study. His love of literature led him to take service in a bookseller's shop, but finding that his duties were those of a drudge, leaving him little opportunity for gratifying his passion, he articled himself when fifteen years old to an attorney. He worked hard at his profession, but still found time to cultivate the Muses,

and, with the assistance of a gifted friend of his own age who taught languages in a school, he read the Classics and began the study of the literature of Italy. He early tried his hand at poetry—imitations of Goldsmith and Shenstone, or translations from the Italian. When he was twenty-four he published a long poem—"Mount Pleasant"—a characteristically stilted eighteenth-century production of no great merit and now forgotten, but which on its appearance was praised by Sir Joshua Reynolds, less, perhaps, for its poetry than for its passionate protest against the iniquities of "that execrable sum of all villainies commonly called the African slave trade"—at that time one of the sources of the commercial prosperity of Liverpool. The courage of the struggling young lawyer in thus inveighing against this vicious traffic roused the anger of some of the wealthiest and most influential of his fellow-citizens. He followed up his attack by another poem on the "Wrongs of Africa," and he had a fierce controversy with an apostate Roman Catholic priest who had published a sermon on the "Licitness of the Slave Trade" as proved from the Bible, for which he had been formally thanked by the Liverpool Corporation.

The coming of the French Revolution was received with enthusiasm by all eager lovers of civil and political liberty in England. Roscoe, who welcomed its advent with inspiriting songs and odes, championed its cause in pamphlets, one of them directed against Burke, who had bitterly attacked the Jacobins. The ardent young Liberal was now identified with the Whig party in Liverpool, and was in frequent communication with its Parliamentary chiefs.

But he was not at heart a politician, and had but little liking for the turmoil and violence of party strife. "Party," he had declared with Pope, "is the madness of many for the gain of a few." His strongest inclinations were intellectual, and as his means increased and he was able to procure books he became more and more drawn to the study of Italian literature and history. The story of the rise of the Medici family, and especially the character and achievements of one of its ablest members, Lorenzo, surnamed the Magnificent, strongly interested and eventually fascinated him. These studies bore fruit in his well-known "Life of Lorenzo de' Medici," published in 1796. The work was received with a chorus of approval. The critics declared there had been nothing like it since Gibbon. Horace Walpole was delighted with it. Men of taste like Lord Lansdowne and Lord Bristol were equally charmed. It even became fashionable, and new editions were speedily called for. The book has been frequently reprinted, and was translated into French, German, and Italian. In Italy it was received with especial favour as a noble tribute to the national genius.

Its literary quality has gained for it an assured place in our literature. As a permanent contribution to Italian history it has less merit. It must be admitted it lacks features demanded by modern and more scientific methods of historical treatment. Roscoe, we may assume, made the best possible use of the material that was available to him. His business prevented him from visiting Italy, but his friend William Clarke, who had access to Florentine libraries, supplied him with such information as he

asked for or could obtain. It is obvious from the work that what mainly interested him was the literary and artistic side of Lorenzo's career, and in particular his influence on Italian art and learning. He had apparently less sympathy with, because he had less knowledge of, his social and political activities. He was imperfectly acquainted with the influences which affected him, or which at times he sought to control. He was sometimes uncritical in his use of authorities, and his judgment was occasionally at fault. But whatever may be its value as a serious contribution to history, there is no doubt of its merit as a piece of literary craftsmanship. It was written under the influence of an enthusiastic sympathy with and admiration for its subject, to which no reader could be wholly insensible, and there is much in Roscoe's subsequent career, both in his pursuits and in his civic activities, to show that he was largely inspired by the example of his hero.

In 1798 appeared his translation of Tansillo's "Nurse," with a dedication to his wife; and in 1805 his "Life and Pontificate of Leo the Tenth" —the son of Lorenzo, and the Pope who saw the rise of the Reformation. Although this latter book brought its author more money, it was less favourably received than his "Life of Lorenzo," mainly on account of his treatment of the Reformation. But apart from this it is less satisfactory as a historical work. His knowledge of the contemporary state of intellectual Europe was too limited to enable him to deal adequately with a subject of so wide a scope. Nevertheless the book had a large sale, in spite of, or possibly in consequence of, the

fact that the Italian translation was placed in the "Index."

Shortly after the publication of his first great work Roscoe renounced his practice as an attorney. Having a competent fortune, he purchased Allerton Hall, a fine old Jacobean house in a beautiful situation on the banks of the Mersey. He now turned his attention to agriculture, set up a model farm near his estate, cultivated the friendship of Coke of Holkham, read papers on agricultural subjects to local societies, and worked at the reclamation of Chat Moss. He also set in order the affairs of a banking house in which his friend Clarke, who lived in Italy, was a partner, and he thereby became involved in its direction and management. But he had still leisure for literary pursuits. He had one of the largest and most valuable private libraries in the district, especially rich in Italian history and literature. He interested himself in typography and induced John M'Creery—a well-known printer of his day—to settle in Liverpool, where his works were printed. He was a generous lover of the fine arts, and has the credit of discovering the genius of John Gibson, the sculptor, originally an apprentice to a marble mason in Liverpool, whom he sent to Rome. Gibson executed for Roscoe a basso-rilievo in terra-cotta, now in the Walker Gallery in Liverpool, the patron in his turn making his *protégé* free of the treasures of his library at Allerton Hall. It was in this way that Gibson first became acquainted with the designs of the great Italian masters. The acquaintance thus formed with the Roscoe family was continued in the case of Mrs. Sandbach, a

granddaughter of the Italian historian, who possessed many of Gibson's works, and was in frequent correspondence with him. Indeed most of the details of Gibson's life were only to be gleaned from his letters to Mrs. Sandbach, who was a very accomplished woman of considerable literary ability.

Mr. William Roscoe was fond of horticulture, and interested in botanical pursuits generally. In the words of the late Professor Asa Gray, he was one of the *Patres conscripti* of the botany of his time, as the author of a monograph on the monandrian plants, and of other contributions on botanical subjects to the *Transactions* of the Linnean Society. Roscoe's influence on the intellectual life of his native town may be seen in the various educational and artistic institutions which he created or with which he was concerned in founding. In 1773, when only twenty years of age, he was one of the projectors of a Society for the Encouragement of the Arts of Painting and Design, the first public artistic society in Liverpool. It had only a short existence, but was revived ten years later, and ultimately developed into the Liverpool Academy, of which Roscoe became President. He designed and etched the admission card to its exhibitions, contributed drawings and read papers to its members. It was the first organization of its kind in the provinces. It not only encouraged local talent, but served to familiarize Liverpool with the work of Reynolds, Gainsborough, and other notable painters of the period. He was a founder and President of the Liverpool Literary and Philosophical Society; an active member of the Liverpool Library, afterwards

known as the Lyceum, and the first public collection of books in the town. He was the means of establishing the Liverpool Atheneum, an institution more especially concerned with the interests of learning and scholarship. His love of horticulture led him to take an active part in the creation of a public Botanic Garden; he drew up the plan of its administration, and at its opening in 1802 gave a thoughtful address on the obligation which rests upon a commercial community to encourage the study of abstract science.

But perhaps Roscoe's greatest service to Liverpool was his share in the foundation of its Royal Institution. He was chairman of the Committee which drew up the scheme of its establishment, and wrote the Report for publication concerning its objects; and at its opening in 1817 gave an address on the part it was calculated to play in fostering the connection which ought to exist between the intellectual and the business life of a city devoted to trade. "It is to the union," he declared, "of the pursuits of literature with the affairs of the world that we are to look for the improvement of both; for the stability and foundation of the one, and the grace and ornament of the other." He was no less mindful of the claims of science: "imperfect indeed would be the civilization of that people who, devoted to the accumulation of wealth by industry, should, from an apprehension of expending their means on useless objects, refuse to encourage scientific inquiries." He pointed out that all improvements in the mechanical arts and in manufactures were to be attributed to the labours and discoveries of those

who had applied themselves to the enlargement of the boundaries of science. Even at that time he was able to show that many occupations hitherto pursued empirically were being practised under a growing recognition that they were based on scientific principles, and that it was only by a wider appreciation of that fact, combined with increased facilities for the acquisition and diffusion of scientific knowledge, that the improvement and expansion of such industries could be secured.

More than sixty years afterwards it fell to his grandson's lot to dilate upon the same theme in the same place, and to indicate how the intervening time of scientific and industrial progress had served to confirm the wisdom and accuracy of his grandfather's insight.

Mr. William Roscoe, however eminent he might be in civic virtue, was precluded from taking any part in the municipal affairs of the town, as he was not a freeman of the borough. Nor, for the same reason, was he able to exercise the Parliamentary franchise. But whilst he himself had no vote, there was nothing to prevent the voters from sending him to the House of Commons as their representative if he and they were so minded. In 1806 a swing of the political pendulum brought the Whigs into general favour, and the burgesses of Liverpool returned him at the head of the poll. By speech and vote he threw all his influence on the side of Clarkson and Wilberforce in their successful efforts to abolish England's participation in the slave trade. Although those who sent him to the Legislature must have known his views on this subject, his constituents were highly

incensed at his action in thus seeking to destroy, as they imagined, one of the chief sources of the prosperity of the town. Moreover, he had added to the enormity of his offence by speaking and voting in favour of Catholic Emancipation. Accordingly, a mixed and muddled mob of ardent Protestants and drunken sailors, crews of slave-ships, were gathered together in order to assail him on his return from Westminster at the close of the session. A riot broke out, but his friends had taken timely precautions, and he escaped without injury. But the House of Commons had few attractions for him. He resigned his seat, and nothing would induce him to seek re-election. He still maintained his interest in the political movements of the time, and became a busy pamphleteer, wrote in favour of the abolition of slavery as a logical consequence of the abolition of the slave trade; on Parliamentary reform; penal jurisprudence and the treatment of criminals; and on national education.

In 1816 Roscoe, whose prosperity had been hitherto unbroken, was overtaken by sudden disaster. The downfall of Napoleon and the termination of the Continental wars were followed by much financial unrest, and a sudden panic seized the bank in which he was interested. Although perfectly solvent—its assets exceeded its liabilities by more than £60,000—it was impossible to realize these assets without grievous loss; the bank's credit had been severely shaken, and it was compelled to stop payment. Roscoe called the bank's creditors together, explained its condition, and convinced the majority that with time its position might be restored. After four years of anxious

efforts to rehabilitate the bank he was forced to give up the struggle owing to the persistent action of a small number, who insisted on preferential treatment, and he allowed himself to be made bankrupt. Allerton, with its beautiful gardens and ample woods, with all its refinements and delights as a home—the home which had welcomed guests like Aikin and his daughter Mrs. Barbauld, Dr. Parr the scholar, Fuseli the painter, Coke of Holkham, Henry Brougham, and many others eminent in politics, learning, and scholarship—had to be given up, together with all its artistic and literary treasures. Thanks to the care he spent in cataloguing these works for sale they realized good prices. Friends vied with each other in preventing the dispersal of the more valuable books and pictures. Many of the former were secured for the Atheneum, on condition that he should be allowed their use, and they still remain on its shelves. His collection of early Italian paintings was presented to the Royal Institution, and is now in the Walker Art Gallery.

Roscoe received an honourable discharge. He was now sixty-seven years of age. With such relics from the wreck of his fortune as could be saved he set himself heroically to retrieve the disaster which had befallen him. Literature, which had been the delight of his leisure, now became his sole remaining prop. Eleven years were still left to him. He rearranged the fine library of his friend Coke, edited an issue of Pope's works, completed the folio monograph on the monandrian plants, and executed a number of other compilations. His old age was spent in a serene dignity which secured for him the friendship of a devoted circle and the universal respect of his towns-

men. He had a paralytic attack a year or so before his death which partially incapacitated him. The end came peacefully on June 30, 1831.

A sitting statue of him by Chantrey, as one of Liverpool's most distinguished citizens, is in the St. George's Hall, and his name is associated with the chair of Modern History in the University of Liverpool.

Washington Irving, in the "Sketch-book," thus spoke of him:

> Those who live only for the world and in the world may be cast down by the frowns of adversity; but a man like Roscoe is not to be overcome by the reverses of fortune. They do but drive him in upon the resources of his own mind. . . . He lives with antiquity and posterity; with antiquity in the sweet communion of studious retirement, and with posterity in the generous aspirings after future renown. . . . The man of letters who speaks of Liverpool, speaks of it as the residence of Roscoe. The intelligent traveller who visits it inquires where Roscoe is to be seen. He is the literary landmark of the place, indicating its existence to the distant scholar. He is like Pompey's column at Alexandria, towering alone in classic dignity.

Henry Roscoe, the father of the subject of this biography, was the seventh and youngest son of Mr. William Roscoe. He was born at Allerton Hall on April 17, 1799. In physical and mental characteristics he more nearly resembled his father than did any other member of the family. He was educated almost entirely at home, and in constant companionship with his father, from whom he acquired a love for rare and curious books and a taste for literature and art.

At the time of the panic of 1816, in which his father was so deeply involved, Henry Roscoe was

serving as a clerk in the bank. After its collapse he entered a lawyer's office, became a member of the Inner Temple, and in 1826 was called to the Bar. He had already turned his attention to literature, and was supporting himself by his pen. In 1825 he gained a considerable success in legal circles by the publication of an elaborate treatise on "The Law of Actions relating to Real Property," and by three small volumes entitled "Westminster Hall," by his "Law and Lawyers," and other works.

In 1828 appeared the first edition of his "Digest of the Law of Evidence in the Trials of Actions at the Nisi Prius Law," which in the next ten years ran through five editions. During 1829 and 1830 he produced a "Digest of the Law of Bills of Exchange," which also passed through many editions, and he contributed to Lardner's Encyclopædia a volume of "Lives of Eminent British Lawyers." For some years he was engaged in the preparation of Parliamentary Bills, and under the direction of Mr. Gregson drew up the original draft of the Reform Bills of 1831–1832.

Two years after the death of his father, he produced the "Life of William Roscoe." This work, undertaken at the request of the family, was no light task, on account of the mass of correspondence, pamphlets, etc., which had to be dealt with. It was completed during three or four months of the legal vacation, when rest and change were much needed. He was already suffering from overwork, confinement, and lack of exercise, and this additional tax upon his strength and nervous energy seriously affected his health.

Between 1830 and 1835 he produced other legal works, among them, "The Digest of the Law of Evidence in Criminal Cases," and a "General Digest of Law from 1835–6," and he contributed to many magazines and journals. In January 1836 he published his last work, a pamphlet "On Pleading the General Issue." During the previous summer the serious state of his health compelled him to abandon the idea of continuing to live in town. He therefore gave up his house in London and went to reside at Gateacre, near Liverpool, in the hope that country air and rural life might improve his condition. He had been appointed in 1834 Judge of the Court of Passage, Liverpool, by Lord Brougham, then Lord Chancellor, and from that year until 1836 he omitted no weekly sitting.

Unfortunately persistent ill-health, aggravated by years of overwork and constant strain, had taxed to the uttermost a delicate constitution, and in March 1837, after a few weeks of suffering, he died at the age of thirty-six.

But for his early death he would certainly have risen to high distinction in his profession. His talents and learning, combined with his moral worth and charming personality, endeared him to his family and to a large circle of friends.

An appreciation by Henry Chorley speaks of him as the most gifted of the sons of the Italian historian —of quick sympathy and solid judgment, and with such instant justice and strength of decision as belongs to a truthful, acute, and strong man.

Certain of his legal books were standard works long after his death. Somebody once asked Sir

Henry Roscoe if "Roscoe on Evidence" was any connection of his. "No nearer than that of father," was the reply.

In 1831 he married Maria Fletcher, second daughter of a respected Liverpool merchant, and chairman of the West Indian Committee,

> An honest man . . .
> Broadcloth without and a warm heart within,

who also was ruined by the failure of a Liverpool bank. Her maternal grandfather, Dr. William Enfield, author of a "History of Liverpool" and of the well-known "Speaker," a man distinguished for elegance of taste and sound literary judgment, was the last rector of the famous Warrington Academy, where he had as colleagues at one time or another, Joseph Priestley, the chemist; Taylor of Norwich; Aikin, the father of Mrs. Barbauld; John Reinhold Forster, the naturalist to one of Cook's expeditions; and Gilbert Wakefield, the editor of "Lucretius."

CHAPTER II

HENRY ENFIELD ROSCOE—BIRTH AND EDUCATION

HENRY ROSCOE brought his young wife to 10 Powis Place, Great Ormond Street, London, and here on January 7, 1833, his only son, Henry Enfield Roscoe, first saw the light. A daughter, Harriet, was born in 1836.

The young judge had little opportunity of making provision for his family, and on his death they were left with very straitened means. His widow moved with her children into a small cottage at Gateacre, and as she had considerable artistic gifts sought to add to her slender income by teaching water-colour painting at a girls' school in the vicinity. She also possessed some of the literary power of her distinguished grandfather, and in 1868 published a "Life of Vittoria Colonna," with admirable translations of the sonnets. She was a strong, vigorous character, devotedly attached to her son and proud of his success in life. Her Manchester friends used playfully to refer to her as "the Mother of Owens College," and the allusion to her association with its fortunes gave her pleasure. She was always deeply interested in its progress and rejoiced in its success. She died at the age of eighty-seven, falling "like autumn fruit that mellowed long."

Young Roscoe went for a few years to a preparatory school in the neighbourhood of his home. In 1842 his mother moved her small charges to Liverpool, when he was sent to the High School of the Liverpool Institute, among the earliest of the so-called "modern" schools. He remained here seven years, taking the usual English subjects—mathematics, French, a little Latin and less Greek, and some elementary physical science. The school was furnished with a chemical laboratory—a very unusual provision in those days—and in it he obtained his first lessons in chemical manipulation from William H. Balmain, the discoverer of "luminous paint" and of boron nitride. Balmain, who was one of the early contributors to the then newly founded Chemical Society, in his published account of the latter substance apologizes for his inability to state its exact composition, as he was unable to obtain a better balance than such as he could construct himself "of wood and paper"—a circumstance which throws some light upon the means of instruction in the laboratory which introduced Roscoe to the study of practical chemistry. He always had a grateful recollection of his first instructor, whom he described as a genial fellow, and a stimulating and original teacher. The boy also came under the influence of Hugo Reid—a noteworthy man, and of some reputation at the time as a writer and teacher of natural philosophy—and of W. B. Hodgson, an excellent teacher of English, who afterwards became Professor of Political Economy in the University of Edinburgh.

Years afterwards, when the "old boy" had become

a person of some consequence in the world, he was invited to distribute the prizes at his school, and told his auditors, in the course of a short address, that he had come across one of his school reports, addressed to his mother, in which it was stated: "Roscoe is a nice boy, but he looks about him too much, and does not know his irregular verbs." He added that he thought this early habit of looking about him, which had persistently clung to him through life, had possibly done more for him than the irregular verbs.

Roscoe's mother encouraged his inclination towards chemical pursuits by providing him with a room at home in which he could make his experiments, and such spare cash as he had was devoted to the purchase of chemicals and apparatus. In this manner he early obtained familiarity with the simpler operations of practical chemistry and laid the foundations of that dexterity in manipulation which contributed so greatly to his success as a lecturer.

Roscoe's forbears on both sides were of Presbyterian or Unitarian stock, and the household naturally moved mainly in Nonconformist circles. These comprised some of the most respected and cultured families in the district—the Booths, Yateses, Martineaus, Taylors, Sandbachs: all well-known names in Lancashire—with some of whom his people were connected by marriage.

In 1848 he was entered at University College, London, at that time the only seat of higher learning and research in England open to men who were refused admittance to the older Universities on denominational grounds. Among the teachers in Gower Street at this period were De Morgan,

Francis Newman, Malden, Sharpey, Graham, Lindley, Williamson, Jenner, and Liston. No more remarkable group was to be found in any institution for higher education in England. Among Roscoe's contemporaries as students were Lister, Langton-Sandford, Farrer-Herschell, Bageot, Jessel, Richard Hutton (who married as first and second wives two of his cousins), Osler, Henry Thompson, and Edward Fry—all names afterwards distinguished in law, literature, and medicine.

Of his teachers at this time, the one who had most influence in shaping his career was undoubtedly Thomas Graham, the chemist. Graham had been elected in 1837, largely through the action of Lord Brougham, as successor to Edward Turner in what was then known as the University of London, founded some nine years previously. Although nervous and hesitating in manner, and with little fluency of speech, Graham was a sound and suggestive teacher, whose lectures were characterized by a philosophic method of exposition, and by accuracy and breadth of knowledge. These were always carefully prepared and well illustrated by experiments. The greater number in the class were, of course, medical students, for in those days there were few followers of pure science, and science faculties and degrees in science were unknown.

Roscoe, in entering Graham's class-room, found himself, as he says, in a new world. One indication of the eagerness with which he exploited it may be gleaned from the circumstance that the enthusiastic young tyro at the end of the session came out the head of the class and gained the silver

medal. His mother and sister soon followed him to town, and the family lived first in Torrington Square and next in Camden Town, where his cousin, Stanley Jevons, the economist, and afterwards one of his colleagues at Owens College, came to reside with them. One of his uncles was Mr. Justice Crompton, who had married into the Fletcher family, and was a great friend of his father. The judge always took a strong paternal interest in his nephew, and would have sent him to Cambridge had he been disposed to go there. The Crompton cousins were, he says, like brothers and sisters to him. It was in their drawing-room in Hyde Park Square that he first met Miss Lucy Potter, his future wife, then a girl of seventeen.

Roscoe now elected to follow chemistry as a career, somewhat to the dismay of his relatives, who, he tells us, imagined he intended "to open a shop with red and blue glass bottles in the window," such being the external indications of the calling of a chemist in this country. And no wonder they were perturbed, for any one not being registered as a "pharmaceutical chemist," or as a "chemist and druggist," who should presume to style himself a chemist was punishable with a fine. Liebig was not altogether well informed of the facts when he wrote to Berzelius that the English chemists were ashamed to call themselves such because the apothecaries had appropriated the name. It was not so much that they were ashamed as they were actually prohibited by law. Although nearly two generations have passed since those days, it may be doubted whether even now the public mind has quite grasped the distinction between a chemist properly so-called and an apothecary.

Having settled upon his life's work, Roscoe entered the Birkbeck Laboratory at University College, then under the direction of Williamson, whom Graham had just brought over from Paris, where he had been working with Laurent and Gerhardt. Roscoe had the highest appreciation of the genius and power of Williamson, and pays grateful homage to his memory in the following extract from his Autobiography :

> At the time I entered the laboratory Williamson was engaged in the researches which have made his name a household word to chemists all the world over. His was a mind of great originality, and his personality was a most attractive one. And, despite his physical disabilities—for he lost an eye and the proper use of his left arm in early childhood—he was a diligent and accurate worker. Ardently devoted to his science, he infected all who worked under him with the same feeling. And his pupils willingly own that much of the success that they may have met with in after years was due to his teaching and example. I well remember the feelings of interest he aroused as he each day came down to the laboratory brimful of new ideas. First it was his explanation of the theory of etherification, of which he proved the truth by preparing the mixed ethers, thereby ascertaining the general constitution of alcohols and ethers, and laying one of the foundation-stones of modern chemistry, Next it was his well-known paper on the constitution of salts, in which he enunciated principles which have since been generally adopted. Then came his views on atomic motion and interchange, the first definite statement of a series of chemical phenomena which in the hands of Van't Hoff and others have become of the highest import. . . . He clearly foresaw the principles upon which the modern development of the steam-engine depends, and though he failed for want of constructive skill, he pointed the way which engineers have since followed with conspicuous success.

In his second year in the Birkbeck Laboratory Roscoe became Williamson's private assistant, and took part in his researches, and when Graham accepted the Mastership of the Mint, and Williamson

succeeded to the chair at University College, Roscoe was made lecture assistant. Williamson had the idea at that time of publishing an abridged translation of Gerhardt's *Chimie Organique*, for the benefit of English students, which Roscoe was to prepare, but nothing came of the project.

Graham, who had been commissioned to send out an assayer to the Sydney Mint, offered Roscoe the position. The salary was very tempting, but as his mother and sister had no desire to go to Australia, the offer was declined, and his cousin Stanley Jevons, who had passed through the Birkbeck Laboratory, was sent in his stead.

It was in recognition of Roscoe's association with Williamson that nearly forty years afterwards he was deputed, on behalf of the subscribers, to present the portrait of his master which now hangs in University College.

Roscoe took his degree of Bachelor of Arts in the University of London, with Honours in chemistry, in 1853, and as he was now more than ever determined to follow a career of science, he decided to enlarge his experience by a course of study in a continental laboratory, as was then the usual custom. Of the great leaders of British chemical science in the first half of the nineteenth century—Dalton, Thomson, Davy, Faraday, Graham—only Thomson and Graham, and to a limited extent Dalton, were in a position to exert any influence as teachers, and even in their case there was little provision of instruction in practical chemistry.

The older English universities had practically nothing of the kind; their disciplines offered no

encouragement to the study of chemical science. The university which prides itself on having afforded a home to Boyle extended no opportunity to a man to make any research unless he found his own laboratory and apparatus. Dr. Liveing started the first laboratory for students in Cambridge at his own expense in 1852, hiring a cottage in the town for the purpose. On the other hand, at that time, thanks to the influence of the French school of chemists; of Berzelius in Sweden; Liebig, Wöhler, Mitscherlich, and the two Roses in Germany, systematic instruction in chemistry was being actively pursued on the Continent, and nearly every leading University abroad could show a more or less well-equipped laboratory, and a body more or less large of eager and enthusiastic investigators. Accordingly, at this period, aspirants for chemical fame in this country naturally turned to one or other of the chemical schools in France or Germany to seek there what they were unable to find at home.

Roscoe elected to go to Bunsen, who had recently been called from Breslau to Heidelberg in succession to Leopold Gmelin, the author of the well-known "Handbuch." Bunsen had already won for himself a European reputation by his masterly investigation of the cacodyl compounds, by the improvements he had effected in gasometric methods, by his investigations on the chemistry of the blast-furnace, his invention of the carbon-zinc battery and photometer, and his inquiries into the chemical aspects of the volcanic and pseudo-volcanic phenomena of Iceland.

It is perhaps idle to speculate why Roscoe should have left Williamson at the most fruitful period of

his career, and when, under his stimulus, organic chemistry was apparently about to enter upon a great development in this country. But the probability is that then, as afterwards, the problems of organic chemistry and the purely speculative aspects of the science had few attractions for him, and that he saw in the many-sided nature of Bunsen's work, in its eminently practical character, and the precision of its quantitative methods, much that appealed to his inclination towards the operative, and especially the determinative side of chemistry, for Bunsen was pre-eminently a master of manipulation, as every one who aspired to a professional career in chemistry and who hoped to direct a chemical laboratory fully recognized.

Roscoe, with his mother and sister, who elected to keep house for him, reached Heidelberg in the autumn of 1853 with an introduction to von Mohl, the Professor of International Law, with whose family they became well acquainted. One of the daughters, Anna von Mohl, was the second wife of Helmholtz. By von Mohl he was made known to Bunsen.

I shall never forget (says Roscoe in his Autobiography) my first sight of him—the man who afterwards became one of my dearest friends, and to whom I owe more than I can tell. . . . He was then at the height of his mental and physical powers. He stood fully six feet high, his manner was simple yet dignified, and his expression one of rare intelligence and great kindness. This first impression of his bearing and character only became stronger as my knowledge of him increased, and the feelings of respect and affection with which I regarded him were those of all with whom he came in contact. His singular amiability was not a sign of weakness, but of strength of character. His modesty was natural and in no degree assumed. In his lectures, when giving an account of some discovery he had made, or some new apparatus or method

of work which he had investigated, I never heard him mention himself. It was always "man hat dies gefunden," or "es hat sich so herausgestellt."

In the cloisters of the old monastery which then did duty as the Heidelberg laboratory, Roscoe was first indoctrinated into the art and mystery of quantitative chemical analysis, and he there acquired the familiarity with Bunsen's methods and with his system of laboratory instruction that he was to turn to such signal account in the establishment and direction of the Manchester school of chemistry. Among his fellow-workers were Lothar Meyer, Pauli, Beilstein, Pebal, Schischkoff (a Russian officer who investigated with Bunsen the course of decomposition of fired gunpowder), Quincke, Bahr, Landolt, Baeyer, Lourenço, and, amongst Englishmen, Russell, Atkinson, and Matthiessen—a group of well-known names constituting a striking testimony to the influence and power of attraction of the great German chemist.

One of Roscoe's earliest quantitative exercises was in silicate analysis, and his first published paper, which appeared in *Liebig's Annalen* for 1854, was a joint production with Schönfeld on the composition of certain samples of gneiss.

At the close of his second session he passed his doctor's examination *summa cum laude*, and then embarked upon the well-known inquiry in association with Bunsen on the measurement of the chemical action of light, which occupied much of his time and energy during the next eight years.

In the obituary notices he wrote for *Nature* of August 31, 1899, and for the *Proceedings* of the Royal Society, and more especially in the admirable

Memorial Lecture which he gave to the Chemical Society, Roscoe has done full justice to the memory of Bunsen as a great chemist, pre-eminent as a discoverer and teacher, and lovable as a true and noble-hearted man. The Memorial Lecture was reprinted in America by the Smithsonian Institute, and translated into German to be prefixed to the collection of Bunsen's works published by the Society—the Bunsen-Gesellschaft—founded in his honour. In course of their long and uninterrupted friendship he received many letters from his illustrious master. These, 126 in number, were suitably bound and presented by him to the Bunsen Society.

Roscoe took advantage of the opportunity afforded by his residence in Germany to study its university system, and to make himself familiar with the general character of its working, and in his vacations he sought the acquaintance of its leading men of science, with some of whom he contracted lasting friendships. ' In his Autobiography, written in 1906, he gives expression to the sentiments of respect and esteem with which he regarded the Germany and his German friends of half a century ago:

My knowledge of the Germans and Germany has led me to love the Fatherland, and, I venture to think, to understand as well as to respect and admire the nation. As to any feelings antagonistic to England and the English existing in the minds of the many Germans with whom I became intimate, I never found a trace, for Treitschke I did not know. All with whom I ever came in contact expressed a feeling that England was the old home of freedom, that she had led the van in securing that freedom by gradual and peaceable measures, and, in short, that the path in which the Englishman trod was that in which they wished to follow. "We cannot," my friends said to me, "express our opinion on political matters with the freedom to which you in England are accustomed. How

indeed can this be otherwise, when we are governed by an autocratic power which believes in the divine right of kings, and have to submit to a condition of things in which summary punishment for 'Majestätsbeleidigung' is possible?"

In the autumn of 1856 Roscoe returned to London, and with the help of friends set up a private laboratory in Bedford Place, Russell Square, with Wilhelm Dittmar to assist him in research work. He also obtained employment as a science lecturer at an army school at Eltham, and did some analytical work on ventilation for a Departmental Committee, the results of which were published in a Blue-book, and also in the *Journal of the Chemical Society*.[1]

The London venture was very short-lived, for in the following year Frankland, the first Professor of Chemistry in the recently founded Owens College, Manchester, resigned his appointment, and Roscoe, who was able to produce satisfactory testimonials from Bunsen, Liebig, Graham, Williamson, and others, offered himself as a candidate for the vacant chair and was appointed.

[1] "Some Chemical Facts Respecting the Atmosphere of Dwelling-houses." By H. E. Roscoe. *Chem. Soc. Jour.* X. (1858), pp. 251-268.

CHAPTER III

OWENS COLLEGE, MANCHESTER

OWENS COLLEGE had its origin in a bequest of John Owens, a merchant of Manchester, who left the bulk of his fortune to trustees to found a collegiate institution in Manchester, open to persons of every variety of creed and free from every religious test. He was born in 1790, the son of Owen Owens, a Flintshire man, who settled in Manchester in early life and established a small business as a hat-lining cutter and furrier. Some time after 1815 Owen Owens took his son into partnership, when the firm extended the scope of their business and became general merchants, shipping calicoes and coarse woollens to China, India, South America, and New York, and importing hides, wheat, and other produce in return.

John Owens was described as possessing a good deal of hard-headedness and practical common sense, a keen buyer and a good payer, very methodical in his habits and operations, and who acted up to his favourite motto, *Honestas optima politia.* He was a staunch Dissenter and a "stalwart" Radical, a shy, silent man, known only to a few intimates, a misogamist, if not actually a misogynist, of no great intellectual ability, and with few cultured tastes, nor, so far as can be gathered, particularly

friendly to learning. There is reason to believe that his first intention was to leave the greater part of his fortune to his lifelong friend and former schoolfellow, George Faulkner, a well-known and prosperous Manchester merchant, who in declining it appears to have suggested the idea of founding a college in Manchester. The suggestion took root. In developing it Owens seems to have been mainly moved by a feeling of bitterness against a system which imposed subscription to articles and creeds on a young man before he could be admitted to the ancient Universities.

He was determined to break down this injustice so far as he was able; he therefore made the trust subject to "the fundamental and immutable rule and condition . . . that the students, professors, teachers, and other officers and persons connected with the said institution shall not be required to make any declaration as to, or submit to any test whatsoever of, their religious opinions, and that nothing shall be introduced in the matter or mode of education or instruction in reference to any religious or theological subject which shall be reasonably offensive to the conscience of any student, or of his relations, guardians, or friends, under whose immediate care he shall be."[1]

John Owens died, unmarried, in July 1846, at the age of fifty-five. Mr. George Faulkner, who had been named as one of the executors, proceeded to carry out the provisions of the will. The estate took some years to realize, and the accounts were not finally closed until 1857, when the total sum received for the purposes of the college amounted to £96,942—not a very large amount considered as endowment, but still sufficient, viewed from the standpoint of the

[1] "The Owens College: its Foundation and Growth." By Joseph Thompson. Manchester: J. E. Cornish.

middle of last century, to enable a modest start to be made, with prudent management on the part of the trustees, and a reasonable amount of sympathy and goodwill on the part of the community that was to be benefited.

The executors, without waiting for the complete realization of the estate, proceeded to execute the provisions of the bequest as regards the projected college. In the selection of the trustees appointed to carry out his intentions John Owens acted with sound judgment and a wise liberality. It is evident from the terms of the will that he had given considerable thought to the character of the institution he wished to found. But in spite of all his care and of the legal skill with which his wishes were expressed, the theological difficulty managed to creep in, and ingenious casuists raised doubts and differences of opinion concerning the interpretation of the testator's will in regard to religious instruction. This occasioned delay, and a certain amount of sectarian jealousy and unfriendly feeling was stirred up which acted prejudicially against the new institution for some years after its establishment.

The College was formally opened in March 1851. Its first Principal was Mr. A. J. Scott, who was Professor of English Literature in University College when Roscoe studied there. In addition to being Principal he was appointed Professor of Logic, Mental and Moral Philosophy, and English Language and Literature. The circumstance that he undertook, with the consent of the trustees, to give courses of lectures on "The Influence of Religion in Relation to the Life of the Scholar," was one cause of the hubbub

which was raised in the town and which brought the Church party to the support of the trustees who had sanctioned these courses. Other teachers were Mr. J. G. Greenwood, Professor of the Language and Literature of Greece and Rome; Mr. Archibald Sandeman, Professor of Mathematics; Dr. Edward Frankland, Professor of Chemistry; Mr. W. C. Williamson, Professor of Natural History, Botany, and Geology; Mr. T. Theodores, teacher of German, Hebrew, and Oriental languages; and M. Podevin, teacher of French.

The College was located in what had been a private house, formerly the residence of Richard Cobden, and situated in a dreary and somewhat disreputable neighbourhood in the vicinity of Deansgate, one of the main thoroughfares of the poorer quarters of the city. This building was purchased from Mr. Cobden by Mr. George Faulkner, the chairman of the trustees, and was subsequently conveyed by him to the other trustees as an absolute donation for the benefit of the College. As it was unsuited for the provision of a chemical laboratory, the trustees determined to erect at the rear of the house a building specially designed for the purpose; but as they were precluded from using any of the corpus of the estate for building, they raised a sum of nearly £10,000 for the installation of a chemical laboratory and lecture theatre, the formation of a library and for general purposes. The chemical laboratory, which was planned under the direction of Dr. Frankland, could accommodate about fifty workers; it was conveniently arranged, and was indeed one of the best of its kind at the period of its erection.

The College made a fairly auspicious start as regards numbers, but for various reasons such popularity as it had rapidly declined, and each succeeding session saw a diminished entry. At the time Roscoe joined the students numbered only thirty-five, of whom fifteen were working in the chemical department.

We gather from the reports of the professors to the trustees that many causes contributed to retard the progress of the institution. 'Curiously enough, one of the chief of these was what was subsequently considered the chief glory of the foundation, namely, its unsectarian character. But another and more practical reason was that the generally unsatisfactory character of the school work of the students prevented them from obtaining full advantage of the College courses. In fact, the training afforded by the College was beyond the desires of the people. Higher education was not considered by Manchester as requisite for the accumulation of wealth. In those days lack of education had little or no effect on the social position of its moneyed men. They were inclined to think that a highly educated youth was unfitted for the routine work of a counting-house and was of little use as a salesman on the floor of the Exchange.

But there were doubtless other causes of a different nature. It was unfortunate for the College that the days of its infancy should be cast in the troubled times of the Crimean War and the Indian Mutiny —events which dislocated trade and affected the prosperity of the district.

It was significant of what the town thought of the

financial outlook of the College that the new professor should be refused the tenancy of a house when the landlord learned that he was one of its staff.

Its ill-success was the subject of leading articles in the local press. The *Manchester Guardian* of July 9, 1858, wrote: "Explain it as we may, the fact is certain that this College, which eight years ago it was hoped would form the nucleus of a Manchester university, is a mortifying failure." And Professor Roscoe was blamed for not awarding the Dalton scholarship because he had the hardihood to say that none of the laboratory students was sufficiently qualified to be worthy of it. The *Manchester Examiner* was somewhat more appreciative of the efforts of the little band who were gallantly striving to raise the very low standard of middle-class education in Manchester at that time.

> We are compelled (it said) to look for the causes of non-success elsewhere than in the collegiate machinery. If an objection can be raised against the College at all, it is that such an institution is either in advance of our felt wants, or altogether unsuited to the economical conditions of Manchester life. Still, this is the fault of the community, not of the College. The worst that can be said of it is that it is too good for us.

This might certainly be said, in a certain sense, of the first Principal of the College. Excellent in many respects as a man, and inspiring as a teacher, he was altogether unfitted to direct the development of the young and struggling institution in such a community and at such a time.

Principal Scott, whom Mrs. Oliphant described as "a man whose powerful, wilful, and fastidious mind has produced upon all other capable minds an impres-

sion of force and ability which no practical result has yet adequately carried out," had little constructive or directive power. Earnest, upright, and conscientious, he was essentially an idealist—almost a visionary—a man of words—forceful and even eloquent at times—but with no capacity for action. As a thinker he lived a strenuous and exhaustive life. Although only forty-six at the date of his appointment, his constitution, never very robust, was already undermined and his nervous energy impaired. He was frequently ill, and his repeated absences from the College necessarily interfered with his administrative work. After struggling for six years with the duties and responsibilities of a position for which circumstances and the times in nowise fitted him, he tendered his resignation as Principal a few months before Roscoe was appointed to the chair of Chemistry and was succeeded by Professor Greenwood.

The public criticism to which the College was subjected was not altogether without a salutary effect on its policy. It must be remembered that it was the first attempt of the kind to bring the higher training, and something of the spirit of collegiate life, directly within the reach of the middle-class youth of a great business community, and it was necessary to have some regard to the conditions of the district and its special requirements and, it may be added, even its peculiar prejudices.

Roscoe's antecedents, his associations with Lancashire, and his knowledge of and sympathy with what is strongest and best in the Lancashire character, made him quick to realize the factors upon which the ultimate success of the institution depended. It was

no use for it to set itself athwart the economical conditions of the community. Young as he was—he was then twenty-four—he was perhaps more alive to the practical necessities of the position than the majority of his colleagues.

He quickly revealed himself as the man of the hour. His accession to the College at this crisis was the turning-point in its career. He brought new vigour and a fresh spirit into its policy, and from that time forward its fortunes began steadily to mend.

As regards his own department, it was his ambition to establish at Owens College a school of chemistry which should worthily serve the interests of the great manufacturing district of South Lancashire—the largest and most important seat of chemical industry in the kingdom. Associated with him in this effort, he had as assistants Frederick Guthrie, who, on his appointment to the chair of Chemistry at the Royal College in Mauritius, was succeeded by Dittmar, and afterwards by Schorlemmer—all men of originality and admirable teachers. Schorlemmer spent the greater part of his life in Manchester, and died in the service of the College, latterly as Professor of Organic Chemistry—the first to be so designated in the kingdom. His connection with the institution is commemorated by the association of his name with one of the chemical laboratories of the Victoria University. His co-operation with Roscoe in the production of the well-known treatise which bears their joint names will be referred to later.

Roscoe from the outset threw himself heartily into the educational and scientific activities of the com-

munity in which he was to make his home for the next thirty years. He joined the Philosophical Society of Manchester—so honourably associated with the name and fame of Dalton. Founded in 1781, the Society has played a worthy part in the intellectual life of Manchester. In the second year of its existence one of its members—the Rev. Dr. Barnes—drew up "proposals for establishing in Manchester a plan of liberal education for young men designed for civil and active life, whether in trade or in any of the professions," which may be said to have anticipated the foundation of Owens College. The management was to be free from sectarian exclusiveness. "A plan formed for public utility should be generous and enlarged, so as to extend itself as widely as possible for the common interest. Science and arts are of no political or religious party." These liberal sentiments commended themselves to the Society, who ordered that the paper should "be printed and offered to the consideration of the public." The seed fell on stony ground at the time and made only a feeble attempt to germinate; two generations had to come and go before it definitely took root.

Roscoe quickly acquired an influential position in the Philosophical Society. He served for many years as its secretary, and ultimately became its president. He was the first recipient of its Dalton medal, awarded to him in recognition of his efforts to throw light upon the reasoning which led Dalton to the formulation of his great generalization, by the publication in association with his friend and former pupil, Dr. Harden, of "A New View of

the Origin of Dalton's Atomic Theory" (London: Macmillan & Co., Ltd.), based upon Dalton's manuscripts and laboratory note-books in the possession of the Society. The book will be referred to at greater length when considering Roscoe's contributions in general to the literature of chemistry.

In the Society at the time Roscoe joined it were several men of scientific eminence, or who played notable parts in the industrial life of the district—among them Joule, Schunck, Fairbairn, W. C. Williamson, Angus Smith, and Crace Calvert. Joule, a pupil of Dalton, a shy, retiring man, was several times President of the Society, and Roscoe, who greatly admired his character and powers as an original thinker, became one of his most intimate friends. In the later years of his life Joule, who was a member of a brewing firm at Stone in Staffordshire, suffered great reverses of fortune, and was only saved from actual poverty by the grant of a Civil List pension, which Roscoe, with the help of Tyndall, Huxley, and other friends of science, was instrumental in obtaining. A letter which Roscoe wrote to the *Times* resulted in the creation of the Joule Memorial Fund, administered by the Royal Society. It takes the form of an international studentship or grant to assist research in those branches of physical science more immediately connected with Joule's work. With the assistance of Lord Kelvin, he secured the placing of a tablet to Joule's memory in Westminster Abbey.

In the vestibule of the Manchester Town Hall a life-size marble statue by Gilbert of the discoverer of the Law of the Conservation of Energy stands

opposite to a statue of the author of the Atomic Theory. It was unveiled in 1893 by Joule's most intimate scientific friend, Lord Kelvin. Concerning this unveiling, Roscoe could occasionally be induced to tell a story. In proposing a vote of thanks to Lord Kelvin, he stated that one inducement that drew him to Manchester was that he might sit at the feet of Joule, whose name was as well known on the Continent as that of Newton, but he found that all that the Manchester of that day knew of Joule was his Stone Ales. One of his lady auditors, in complimenting him upon his little speech, observed: "Of course I quite understood your remark about sitting at Dr. Joule's feet, but why make allusion to his *toe-nails!*"

The visit of the British Association to Manchester in 1861, when Roscoe served as one of the local secretaries, afforded him an excellent opportunity of showing his organizing powers and business aptitudes.

These were still further demonstrated in the winter of 1862, during the memorable cotton famine in Lancashire, when he acted as one of the secretaries to a committee created to provide some form of intellectual occupation for the thousands of operatives thrown out of employment by the stoppage of the staple industry of the district. He gave lectures, illustrated by experiments, on subjects likely to attract a working-class audience. These were highly popular, and undoubtedly awakened a general interest in scientific matters in quarters which knew nothing of science. Their success encouraged him to institute the series of Science Lectures for the People, which he began in 1866, and carried on for eleven con-

secutive winters. In this movement he secured the co-operation, amongst others, of Huxley, Carpenter, Tyndall, Huggins, Lord Avebury, Abel, Stanley Jevons, Clifford, and Spottiswoode. The lectures were given in some of the largest public halls in the city, and were attended by thousands. They were published week by week as delivered, and were sold for a penny all over the world.

In 1874 the writer, then recently appointed to the newly founded Yorkshire College at Leeds, had the privilege of taking part in these courses, when he undertook to give some account of the life and work of Joseph Priestley, the chemist, who, as already stated, was a colleague of Dr. Enfield at the Warrington Academy.

Mrs. Roscoe, the mother of the subject of this memoir, then an old lady of seventy-six, who had shown the writer many kindnesses during his student-days at Owens College, was pleased to interest herself in this lecture and, unsolicited, to write the following characteristic and charming little sketch of Priestley and his wife as a contribution to the subject.

10 York Place, Oxford Road,
November 12 [1874].

My Dear Professor,

I have a few particulars at your service for your lecture on Priestley if you intend to sketch his character, which was a fine example for working-men. I should be glad to send you the papers if you will return them. You of course have Huxley's enlarged notice in the *Contemporary*, which is very good and full.

His poverty, energy, and extreme industry raised him from the humblest condition. His first place of Christian ministry for three years was at a small chapel at Needham, and his stipend only £30

a year, to which he added a small school. Here he bought a pair of globes (made by John Senex, F.R.S.). When he removed to Nantwich, where he was minister for three years, he took the globes with him, and also kept a small school. There he bought a small air-pump and an electrical machine and a few books, going on with preaching, teaching schools, and learning himself. He says: "I was barely able, with the greatest economy, to keep out of debt—but this I always made a point of." (The globes and the first electrical machine belong to friends of mine.—M. R.)

In 1761 he removed to Warrington, where he remained six years, connected with the Academy there. Here he married his wife—a most admirable woman—who excelled so greatly in ruling the home that "it allowed him to give his whole time to the prosecution of his studies and other duties." Her behaviour during the Persecution and Emigration to America was above all praise. She said of herself: "There is something inherent in me which always makes me swim to the top of affliction, so that I am ready to pop out to the first friendly hand that offers assistance—otherwise I am surprised at myself that I have borne it so well, and greatly rejoiced that Dr. Priestley has kept up under all the malignity that attended the riots. Our property may be said to be entirely destroyed, the few remains that have been picked up so demolished as to be of little value." The loss of books, MSS., and instruments was valued at £10,000.

There is an interesting chapter on visiting Priestley's grave in Harriet Martineau's "Retrospect of Western Travel," vol. i. pp. 175–90. Also a poetical account of the uses of oxygen by George Dawson of Birmingham, which I cut out for you. The list of all Priestley's works and portraits, medallions and engravings, as well as remains of other kinds, is given by Rev. James Yates, and appended to the Life of Priestley by Hutt.

Priestley was driven from England in 1794, and Lavoisier was guillotined in the same year at Paris after confiscation of all his property; and it was in 1874 that Birmingham was "made to eat humble-pie" by erecting a statue to Priestley's memory on the centenary of his great discovery.

I hope you have made a good beginning at Leeds and will nevertheless not be too busy to read this note and to excuse my troubling you.

Very truly yours,

MARIA ROSCOE.

Of the stimulating influence of these Penny Lectures Roscoe received abundant testimony: in after-life he frequently met persons, some occupying a high and responsible position in commerce and industry, who informed him that they were indebted to them for their first interest in science. One such person was the late Mr. Thomas Parker, a self-made man, and founder of the well-known electrical firm of Elwell-Parker.

Services such as these, combined with Roscoe's growing popularity and influence, necessarily reacted favourably upon the fortunes of the College, and it steadily grew in favour. The chemical department especially increased in numbers, and the laboratory soon became inadequate to accommodate the students, who came to it from all parts of England, attracted by its fame as a chemical school.

The prospects of the College were now so well assured that in 1865 the governing body and the professors began to consider the desirability of extending its scheme of studies, and, what at the moment was even more urgent, providing new and greatly increased accommodation. Owing to the adverse state of trade at the time, no immediate steps were possible; but in 1867 a town's meeting resolved "That the time had come for the public of the district to unite for the purpose of developing the College on a more comprehensive scale, and in appropriate and convenient buildings." An executive committee, on which Roscoe was placed, was appointed to carry out this and certain consequential resolutions. He was also required to serve on various sub-committees, dealing with the new site, buildings, extension and re-

arrangement of courses of study. It says much for the influence and weight he had now acquired in the counsels of the College, and for the confidence reposed in his judgment and business capacity, that no other member of the staff was called upon to take so large and so responsible a share in the extension movement.

The new Constitution as settled by the extension committee, to the extent that it modified or enlarged the original scheme of the founder, necessitated an application for a Bill in Parliament. The action of the Governing Body in enlarging the scope of the College was generally approved and was warmly supported, amongst others by Mr. Freeman the historian. He considered that the members of the two ancient Universities ought to feel, and he was sure that they largely did feel, a special sympathy in the planting of an institution like Owens College in such a city as Manchester.

It was called a college, but it had really much more of the character of a university; and it was as a new university in Manchester that he was ready and delighted to welcome it. It was a great and noble work which had been begun in their city. . . . He looked then upon Owens College as a university rising in a great city; neither did he look on a great city as an unfitting place for a great university. As a rule, the ancient universities of Europe had arisen in great cities. Owens College, unlike most modern institutions, did not begin with a building. Here was a college which had been at work for a good many years, and the common academical buildings were only now being planned. This was just as it should be; at any rate it was just in the spirit of the old founders. They got their men first, and let the buildings come afterwards. If Owens College had hitherto to do with makeshift buildings, it was just what the old colleges of Oxford did for a while, and in both cases for the same reason, because the college itself, the living members of the college, came first in the ideas of the founders, and the material house existed for their sake only.

The draft of the new Constitution was prepared, under the direction of a sub-committee, by Mr. James Bryce, now Lord Bryce, then Regius Professor of Civil Law at Oxford, and formerly Professor of Jurisprudence and Law at Owens College. A Bill was next drafted to enable the College to procure modifications of certain features of John Owens's foundation, and Roscoe was requested to sign as one of the promoters of the petition for the Owens College, Manchester, Bill, 1870. This Bill met with a certain amount of parliamentary opposition, mainly in the House of Lords, where it was first introduced. It was alleged that it was a Bill for incorporating a non-existent charity, enabling it to annex the property of another charity and to set aside to a great extent the expressed intention of the founder. Objections also were raised in Manchester itself by the executor of the late chairman of trustees, on the ground that it was proposed to include females as students of the College. The promoters met both the parliamentary and local opposition with skill and judgment. The Lords passed the second reading by a majority of nearly six to one, and as no petitions were lodged against it after lying on the table for forty days, it was read a third time and passed. In the Commons the Bill was read a first and second time without opposition. A difficulty was threatened in Committee in regard to the inclusion of the words, "A college wherein young persons, including if and when the proper authorities of the College so direct, persons of the female sex, may receive instruction." This was stayed by the promoters agreeing to accept in lieu

the words "such young persons as the proper authorities of the College may from time to time direct"—a sapient amendment which made little or no essential difference when the inclusion of women came to be dealt with as a practical question. The Owens College Extension Act received the royal assent in July 1870.

The foundation-stone of the first block of the new buildings was laid by the Duke of Devonshire, the first President of the Owens College, on September 23, 1870. The design of the chemical laboratories was wholly inspired by Roscoe, after a careful examination of every continental example that might furnish suggestions concerning internal arrangements and fittings, the details being admirably carried out by the late Mr. Alfred Waterhouse, R.A. It is not too much to say that these laboratories have served as models for practically every chemical laboratory which has been subsequently built in this country or abroad.

Roscoe's interest in the new buildings was not by any means exclusively confined to his own department. As a member of the building committee he took an active and leading part in its work generally. The position he thus acquired may be illustrated by the following story. When Principal Greenwood was asked how many master-keys would be needed by the staff, he replied: "Three: one for me because I'm Principal; one for Ward as Pro-Principal, and one for Roscoe because he is Roscoe."

The actual incorporation of John Owens's trust within the scheme of the extended College could only

be effected with the sanction of the Charity Commissioners. There was no difficulty in the trustees of the original College and the governors of the enlarged institution coming to an agreement. The difficulty was raised by the Charitable Trusts Commissioners, and it again arose on the question of the "eternal feminine," the inclusion of women being held to be a departure from the expressed objects of Owens's foundation. After a lengthy correspondence this and certain other points raised by the Commissioners were adjusted, when a Confirming Bill was introduced into Parliament; it passed through both Houses and received the royal assent in July 1871.

The Owens College was now free to develop towards that consummation to which all friends of education desired it should proceed.

It had gradually enlarged the scheme of its studies so as to include nearly every department of learning, other than theology, professed at the older universities. It was inevitable therefore that sooner or later it should seek for university powers. That this was to be its goal was clearly foreseen by all who were actively engaged in its extension. The main difference of opinion was as to whether the time was opportune. Many distinguished friends of the College, who had watched its development, were of opinion in the late 'seventies that it had already attained a university position, and that steps should then be taken to make it the university of Manchester.

The idea of a Manchester university was not by any means new. It was as old, indeed, as 1640,

when Henry Fairfax, Rector of Ashton-under-Lyne, moved his brother, the second Lord Fairfax, to petition the Long Parliament

"for an university to be erected at Manchester, as the want of an university in the northern parts of this kingdom, both in this and former ages, hath been apprehended a great prejudice to the kingdom in general, but a greater misery and unhappiness to these countries in particular, many ripe and hopeful wits being utterly lost for want of education, some being unable, others unwilling, to commit their children of tender and unsettled age so far from their own eyes, to the sole care and tuition of strangers."

Lord Fairfax replied that this could not be done except by a Bill in Parliament, "which will be a charge of one hundred marks at least [£66 13s. 4d.], too much to be hazarded on so great an uncertainty."

The successive stages in the growth of this conception are given in Mr. Joseph Thompson's "History of Owens College." These can only be shortly indicated here.

The establishment of a university at Manchester was boldly advocated in 1829 by Mr. W. R. Whatton, who contemplated the alteration and extension of the plan of the existing Royal Institution for the purpose, and drew up a scheme of higher education on a wide and liberal basis. Mr. Whatton combated the objections which were raised with considerable skill, but the "religious difficulty" got mixed up with the controversy: it proved insurmountable and nothing came of the project. In 1836, Mr. H. L. Jones read a paper before the Manchester Statistical Society on a plan of a university for the town of Manchester, which was subsequently published in pamphlet form at the expense of the late Mr. James

Heywood, F.R.S., a well-known Manchester worthy. Mr. Jones, who was a member of the University of Cambridge, was a strong advocate of university reform and of the principle of introducing university culture into the larger industrial centres, in a form suited to the intellectual needs of modern life. An attempt was made to put the scheme into effect, but it died of inanition in a few months. It is, however, interesting to note that many details of Mr. Jones's plan foreshadowed what were subsequently adopted in the arrangements of John Owens's foundation. Naturally the idea eventually centred itself in this institution. The language of the local newspaper Press in the early days of the College, even when its fortunes were at their lowest ebb, clearly indicates what was the hope and aspiration of the more public-spirited and thoughtful of the community. As the College grew and prospered, their hope was strengthened and their aspiration encouraged by friends of education from the older universities like Freeman the historian, by men of science like Lord Kelvin, Huxley, and Brodie, and by public men like Lord Bryce and the late Lord Avebury.

With the provision of new buildings, spacious class-rooms and admirable laboratories, designed by an artist who has left the impress of his genius upon some of the most noteworthy architectural features of the city, Manchester now realized that it possessed a temple of learning of which it might well be proud. And there can be little doubt that this fact quickened the local feeling in favour of the realization of that hope which, however faint at times,

had persisted, in spite of many disappointments, for more than two hundred years. A few months after the College had been installed in its new premises, Roscoe and his colleagues, Professor Ward—now Sir A. W. Ward, the Master of Peterhouse, Cambridge—who was then Professor of History in Manchester, Principal Greenwood, and Professor Morgan, took the first effective steps towards this consummation. The historian of Owens College thus testifies to their action:

> It is to the zeal and untiring devotion of these four gentlemen (wrote Mr. Joseph Thompson) that Manchester owes its university; others cordially supported the movement, but they, through five weary years, placed their case before the public, removed prejudices, advanced good arguments, and lived down opposition.

Roscoe has himself told the story of how he attempted to move Lancashire through the local Press, and strove to create a public opinion in favour of the project, for, as he clearly recognized, without public support nothing could be accomplished. He sought to show how the establishment of a new university in the North would benefit the great middle classes of the community in which it was placed, and what its influence might be expected to be upon the great hives of industry in the most densely populated districts of the kingdom. It was, he said, to be "The University of the Busy," as distinguished from the old universities of Oxford and Cambridge—"The Universities of the Wealthy." He pointed to the existence of the Scottish universities, and explained what their influence had been for generations back on the middle and poorer classes of their country,

Was not Lancashire, with its many populous manufacturing towns, as fully entitled to the advantages of a university as the cities over the Border? The time had passed for imagining that Oxford and Cambridge, rich and powerful though they were, could do all that England legitimately required in the way of the highest academic culture. Where was the evidence that the establishment of provincial universities would lower the tone of higher education, or that the creation of new avenues to degrees would injuriously affect the reputation of those symbols of culture? That "many ripe and hopeful wits" among the youth of Manchester were well qualified for and desirous of receiving university training, but who, for a variety of reasons, could not go to the older universities, was no less true now than in Cromwell's time. Moreover, it must be admitted, there is a great deal in the *genius loci*. That spirit had succeeded in developing John Owens's foundation into a splendid institution suited to the local life and requirements. They in Manchester knew what the busy North wanted, but they were not quite so sure that the Dons of Oxford and Cambridge knew it as well as they themselves did. They asked to be allowed to work out their own salvation in their own way. They were already to all intents and purposes a university; their students were university students in age and education, and their courses of instruction were fully up to university standard, and their yearly entry would compare not unfavourably with that of many universities in our own and other countries.

Other arguments were adduced, possible objec-

tions were anticipated and met, and a strong case was established. The senate, however, moved cautiously. They proceeded to collect and circulate opinions on the propriety of seeking a university charter, and eventually the matter was brought before the court of governors, who appointed a special committee, on which Roscoe was placed, to consider and report upon the whole subject. A considerable number of persons, heads of colleges, university teachers, and others eminent in the educational world, or who had identified themselves with educational movements, were consulted, and with the consent of the writers their replies were collected and distributed to the leading newspapers and journals with a view to elicit public opinion. An analysis of the general feeling so far as it could be ascertained from newspaper and other criticism was made by Roscoe in concert with Principal Greenwood and Professor Ward, and laid before the special committee. The *Liverpool Daily Post* was adverse to the project, for reasons which will appear subsequently. The late Lord Sherbrooke, who, as the Rt. Hon. Robert Lowe, at that time represented the University of London, was equally condemnatory in the pages of the *Fortnightly Review*. But the preponderating opinion was undoubtedly favourable.

The committee reported, some six months after its appointment, to a special meeting of the governors, when it was resolved, with practical unanimity, that it was expedient to take such steps as might be calculated to promote the success of the proposal to seek for the Owens College a charter as a university

granting degrees. A memorial was presented to the Privy Council through the Lord President of the Council (the Duke of Richmond and Gordon), praying for the grant of a charter to the College conferring upon it the rank of a university, to be called the University of Manchester, with power to grant degrees in arts, science, medicine, and law. The memorial was influentially supported by eminent men, who recapitulated the arguments which had led the governors to their decision; it was further supported by memorials from the corporations of the chief towns of Lancashire (Liverpool excepted), and from a number of public bodies and educational institutions in the county.

The very success of Owens College as an educational agency in the town and district in which it was situated was, for the moment, the cause of opposition to its attempt to obtain for itself university powers. Other towns, conscious of the benefit of such institutions, were seeking to establish colleges of the type of Owens College, and which it was hoped might ultimately develop into universities. Leeds had founded the Yorkshire College in 1874. Originally started as a science college, and with special reference to the educational requirements of the industries of the district, its scope had been rapidly enlarged so as to include arts and languages. It had already established relations with the local medical school, and its development as a college was not very dissimilar from that of Owens prior to the extension movement. At that time it had upwards of four hundred students—registered occasional, medical, and evening—with some eighteen professors, instructors, and assistants, and an

income from fees of about £1,500. The governing body of the Yorkshire College, and others interested in its progress, therefore viewed with some apprehension the establishment of a degree-granting body so close to its own area. The majority were not opposed to the creation of another university in the north of England, provided that the interests of their own college were safe-guarded. They desired that the charter of the contemplated university might be so modified as to admit of the inclusion of other institutions of collegiate rank which might be able to fulfil the conditions of incorporation as constituent colleges with a definite share in its government. This, indeed, was actually contemplated by the promoters of the Manchester University, but the terms of incorporation were, in the opinion of Yorkshire, not sufficiently well defined, and there were other conditions which failed to satisfy local aspirations. The friends of the young College were keen and active; the Leeds Press took up their cause, and public opinion in the district set strongly in their favour.

As the action of the neighbouring county was successful in effecting certain fundamental modifications in the Constitution of the proposed new University, it may be desirable to give some account of the origin and growth of the Yorkshire College up to the period with which we are now concerned, and to point out the reasons which seemed to its friends to justify their efforts to safeguard its position in the interests of the higher education of an industrial community hardly less populous than that of Manchester and its immediate vicinity.

CHAPTER IV

THE YORKSHIRE COLLEGE

THE Yorkshire College of Science, as it was first styled, had its origin in the general movement towards a fuller recognition of the duty of the community in regard to national education, of which the Education Act of 1870, the Technical Instruction Act of 1889, and the more comprehensive Education Act of 1902 were at once the signs and the practical outcome. The immediate cause of the creation of the College may, however, be said to have been found in the Paris Universal Exhibition of 1867. One of the reporters of that exhibition was a well-known Leeds merchant, the late Mr. Thomas Nussey. In a report in vol. iii of the General Reports, Mr. Nussey drew attention to the great advance that had been made since the London Exhibition of 1862 in the quality, style, and cheapness of production of the foreign exhibits. Whilst he was of opinion that Great Britain might still be said to maintain its pre-eminent position in the woollen industry, Leeds and the West Riding generally had failed in many classes to make the best use of their opportunities. He proceeded to point out to what in his judgment the great advance in the character of the continental production was due. He says:

The Right Hon. Sir Henry E. Roscoe

There can be no doubt that the French, Belgian, and Prussian manufacturers are greatly indebted for their progress in this and many other industries to the very superior technical education which their manufacturers and workmen obtain by means of the schools instituted for special instruction, not only in design, but in everything which has any relation to each particular manufacture. Without education we cannot expect to have skilled workmen of the highest class, and to a fair general education must be added a special training under good masters in every branch of trade. The adoption of similar schools in Britain will before long become a necessity, and the sooner they are established the better.

Prompt effect to these opinions was given by two other members of the same family in a pamphlet, published in Leeds, entitled: "A Technical Institution for Leeds and District, proposed by George Henry Nussey and Arthur Nussey. Leeds: Edward Baines and Sons, 1867." This institution was avowedly designed to serve the interests of the staple industries of the West Riding. Its projectors formulated a scheme of technical education which should in the first place combine the existing School of Art with a School of Weaving and Design, and should afford instruction in mechanical engineering; in the manufacture and dyeing of woollen and worsted goods; in weaving and designing; in the manufacture of linens, and of leather; in mining, metallurgy, and building construction. Two years later they sought to give a practical development of their ideas by establishing "The Leeds Art and Science Institute" in connection with the Science and Art Department, South Kensington. Six teachers and assistants were engaged and the classes were held in the evenings.

Other agencies, however, were at work tending to the same end. There is a small social organization

in Leeds which has existed since 1849, known as the Conversation Club, and which, with less ambitious aims, has played much the same part in the intellectual life of the town that the famous Lunar Society did in that of Birmingham. In this club the idea of an Educational Council for Leeds took its rise, and out of this grew the Yorkshire Board of Education, of which Lord Frederick Cavendish, M.P., was President, and Sir Andrew Fairbairn, and Dr. J. D. Heaton, an active member of the Conversation Club and of the Educational Council, were Vice-Presidents.

The work of the Board up to the period of which we write had been mainly concerned with the provision of science classes and science teachers, in connection with mechanics' institutions working in conjunction with the Science and Art Department.

In 1869 a meeting of the General Council of the Yorkshire Board of Education was held at the Town Hall, Leeds, with Lord Frederick Cavendish in the chair. It was attended by representatives of the more important industries in Yorkshire, as well as by persons interested in higher education. A resolution was carried "That in the opinion of this Council it is desirable that a College of Science should be established in Yorkshire"; and a committee was appointed "to investigate, consider, and propose the best means of carrying out the proposal." Members of this committee naturally visited, in the first place, the neighbouring Owens College, and gained valuable information concerning its rise and progress and the nature of its operations, much of which was embodied in their report; others visited

King's College, London, in order to inspect its Department of Applied Science and Engineering Workshops. Correspondence was also entered into with the Endowed Schools Commissioners, who held out prospects of assistance for Exhibitions in Physical Science and in the Secondary Education of Girls.

The Committee presented their report in 1872. Their suggestions were limited by the probabilities of realizing them. Too ambitious a scheme would overreach itself: public support would probably be deterred by the very magnitude of the effort needed to give effect to it. On the other hand, no attempt would be worth making unless it afforded reasonable assurance of practical benefit. After full consideration the Committee recommended the establishment of the following professorships: (1) Mathematics and Engineering; (2) Chemistry; (3) Mining, Metallurgy, and Geology; (4) Experimental Philosophy; and they came to the conclusion that the minimum sum required for a beginning was £60,000, which they apportioned as follows: site and buildings, £25,000; endowment, in addition to students' fees, £25,000; establishment expenses, £10,000.

The Council accepted the report, and at once appealed for subscriptions. Sir Andrew Fairbairn headed the list with £1,000, followed by like amounts from the Duke of Devonshire, Sir Titus Salt, Bart., Messrs. Beckett & Co., the Low-moor Iron Company, and Messrs. Hargreave and Nusseys, members of which firm had started "The Leeds Art and Science Institute." The project, however, made but slow progress: pecuniary support was difficult to secure, and the Committee were

forced to realize that if a start was to be made something less than the £60,000 would have to suffice. It was therefore resolved to postpone all building operations and, when a sum of £20,000 had been raised, to make a beginning in temporary premises.

In April 1874 it was reported that the subscription list amounted to £25,000, and on the 30th of that month a meeting of the subscribers and donors was held in Leeds for the purpose of defining the Constitution of the proposed College and electing a Board of Governors. Lord Frederick Cavendish presided, and Dr. Heaton made a statement explaining the progress of the movement, and the steps it was proposed to take in order formally to constitute the College. In addition to the amount subscribed, the promoters were able to announce offers of help in money, as well as in science exhibitions, from the Endowed Schools Commissioners. The Clothworkers' Company of London promised £500 a year to found a Chair of Textile Fabrics. But Dr. Heaton went on to remark:

> The work is far from being completed; it may be said to be only commencing. The governing body have an arduous task before them, both in organizing the College and in still prosecuting the canvass for subscriptions. £20,000 neither represents the amount to be expected from the large and wealthy West Riding of Yorkshire, nor does it approach to the amount necessary to give permanency and full efficiency to the institution which we desire to establish. Although it is proposed to commence operations in a rented building, both because our present means would not permit of the purchase of a site and erection of buildings thereon, and because of the long delay which would be occasioned by waiting for the completion of a building yet to be erected, it is most desirable, indeed essential, that the College should ultimately possess its own

buildings, appropriately constructed and arranged for carrying on its work with the greatest efficiency and convenience. We have often been asked if Government should not assist the work we have in hand. Continental Governments do provide for scientific teaching as applied to industry, and it might be well if our own Government did more to promote this great national work. In this country we have always been left to do more for ourselves by individual action and by voluntary benevolence; and our national self-reliance and powers of organization and practical benevolence are no doubt strengthened and developed by our people being left to their own resources. But inasmuch as all are interested directly or indirectly in the commercial prosperity of the nation, this does seem to be an object towards which (when it is once commenced by private exertions) some assistance and encouragement by the Government would be peculiarly appropriate.

In the early autumn of 1874 the Council proceeded to appoint the first professors of the College. The committee which drew up the scheme of instruction had recommended the inclusion of the subject of Engineering, with which should be associated the teaching of Mathematics by the same professor. However desirable it might be to make provision for instruction in the principles of Engineering—especially in Mechanical Engineering, in view of its bearing upon one of the most important industries of the town and district—the Council, for various reasons, were unable to give immediate effect to this particular recommendation. The subject of Mechanical Engineering, to be properly taught, requires the provision of workshops, laboratories, and an installation of costly plant. Even if the limited resources of the College had been sufficient at the time to make the most modest of beginnings, the temporary premises which had been leased would have been unsuitable for the purpose. Accordingly the authorities, with that

characteristic Yorkshire caution which takes nothing on trust, goes no further than it can plainly see—nor, in the common phrase, puts out its hand further than it can draw it back again—decided to limit their appointments, to begin with, to Professorships of (1) Experimental Physics (with which they associated Mathematics); (2) Geology and Mining; (3) Chemistry. To the first Chair they elected the late Mr. A. W. Rücker, Fellow of Brasenose College, Oxford, and a Demonstrator in the Clarendon Laboratory—afterwards Sir Arthur Rücker, Sec. R.S., Professor of Physics in the Royal College of Science, London, and subsequently Principal of the reorganized University of London. To the second they appointed the late Mr. A. H. Green, formerly Fellow of Gonville and Caius College, Cambridge, and a distinguished member of the Geological Survey, who subsequently became Professor of Geology in the University of Oxford. For the third appointment the Council selected the present writer, who had been a pupil, assistant, and demonstrator under the subject of this memoir at Owens College, and who, prior to his selection, had held the Chair of Chemistry in Anderson's College, Glasgow, now merged into the splendidly endowed and equipped Royal Technical College.

The premises in which the College was first housed consisted of a disused Bankruptcy Court situated in Cookridge Street, one of the main thoroughfares leading out of the town. After a somewhat chequered career the building had been partially used as a school of cookery, with the unfortunate result that it had been largely consumed by a fire just prior to being

taken over by the College authorities. Although not so spacious as Richard Cobden's old house in Quay Street, Manchester, in which Owens College first started, the Leeds building, in some respects, was not ill-adapted to the purposes of the limited professoriate with which the Yorkshire College of Science began its operations. At all events, it accommodated without the slightest difficulty all the students who sought admission to its classes on its opening day.

The College began its work of teaching on October 26, 1874—somewhat later than the normal time of opening a session—owing to delays in completing the necessary structural rearrangements. But as there was no yearning anxiety on the part of anybody to learn, no special inconvenience or disappointment resulted. There was no preliminary flourish of trumpets; hardly so much as an opening speech. The initial ceremony was as simple as the appointments of the College were modest. Each of the three professors in turn gave an introductory lecture to an audience consisting of the members of the Council and such of the friends of the embryo institution as cared to attend. Some encouraging remarks were made by the Chairman, and so the College was launched. But for a time the students were few and their advent as far between as the visits of angels.

Still, as the session progressed and the existence of the place became gradually known the numbers slowly crept up, and by the end of the summer term they had reached twenty-four and the students' fees had amounted to about £150. The authorities now determined to open the next session with an Inauguration Ceremony. October 6, 1875, is a

red-letter day in the history of the College, for on that date one of the most notable and helpful gatherings ever held in honour of the College took place. The proceedings began at noon, when the College buildings were inspected by a specially invited company; thereafter there was the inevitable public luncheon and in the evening a general meeting in the Town Hall. On each occasion the Duke of Devonshire was in the chair. At the College meeting Lord Frederick Cavendish, its President, gave a short account of its origin and aims. They were there, he said, to take care that they did not through ignorance waste the natural wealth of the county, or stay the further development of the natural qualities of its people. Wealth, however, was not much in itself but only as a means. Were they quite certain that in the great wealthy industrial North they had made the same progress in intellectual culture and refinement as they had in wealth? He pointed to the example of Owens College: inspired by that College, they would try in Yorkshire if they could not do something of the same sort.

At the luncheon similar sentiments were uttered by the Dean of Durham, the Marquess of Ripon, Canon Robinson, Sir Edward Baines, and Mr. W. E. Forster. It was, however, at the evening meeting that the real success of the day was achieved. The Victoria Hall was filled with a typical Yorkshire crowd—alert, receptive, keenly interested, alternately critical and tolerant, yet ready to be swayed by those who knew how to reach their intelligence and rouse their enthusiasm. The Duke of Devonshire opened the proceedings with a dignified and impressive

address, worthy of his high position as Chancellor of the University of Cambridge and as President of the College in the neighbouring city of Manchester. He gave a broad and comprehensive account of the general state of educational activity in the country and indicated the directions in which it was tending. He pointed to the creation of institutions for secondary and higher education in our large centres of industry as a sign that the country was awakening to the fact that all our great branches of industry were founded on a scientific basis. Although the education—however indispensable it might be—of the eye and the hand could only be acquired by actual practice, it could be nothing short of prejudice to deny that the education of the intellect was also a matter of primary importance. The Duke affected no flights of eloquence. His diction was simple and unaffected, and a vein of strong, practical common sense ran through the whole of his remarks. His presence was not unfamiliar to a Leeds audience, but they never heard him to greater effect, or, it may be added, at greater length. His speech was said to be the longest he had ever made.

The late Lord Playfair, who as Dr. Lyon Playfair then represented a Leeds constituency, followed on the same theme. He recalled the fact that more than a generation had passed since standing on a Leeds platform he had acted as interpreter to his friend Liebig in warning his audience not to pride itself too much upon its industrial achievements, explaining how impossible it was for England permanently to preserve her manufacturing supremacy among nations, unless she bestowed more attention

upon the sciences which formed the groundwork of her industries. Then, in one of those hortatory discourses with which he occasionally astonished and delighted an ill-informed House of Commons, he poured forth a wealth of facts in illustration of the movement in the industrial world which had rendered these modern colleges an imperative necessity.

Foreign nations had seen that their only chance of compensating themselves for our advantages in the materials of power and strength was to excel us in the intelligence and intellect applied to their use in production. They saw clearly that as new forces and their application were brought to aid industrial production, human labour was relieved from much of its drudgery, and that the conceptions of the brain became more important than the sweat of the brow. Look to Switzerland, as an example in point. She has no coal, and no seaboard by which she can introduce it. Separated from other countries by ice-clad mountains, and hemmed in by hostile tariffs, she still becomes an industrial nation. What has led to her great industrial industry? Not her water-power, for that she is only beginning to use effectively, but simply the educated intelligence of her whole population. Valleys in which a few years ago you only heard the tinkling of the bells of cattle as they strayed through the pastures are now busy with turkey-red works and calico print works. Our manufacturers shake their heads sagaciously, and say, "This is because the air and water of Switzerland are so well adapted for colours." But the true explanation is contained in the answer of Opie, the celebrated painter, who being asked by an ambitious youth how he mixed his colours, replied "I mix them with my brains, sir."

Every part of public education in Switzerland is well co-ordinated and organized. At Zurich, in addition to a university for general culture, there is a technical college larger than Buckingham Palace. And so Switzerland laughs at countries which look to raw materials as the source of their wealth, and imports cotton from the United States, tobacco from Havana, silk from Italy, and sends back to these very markets her finished products. Again, look at Holland, which is a reclaimed swamp, containing no mineral materials for

industry, except in a small patch at Limburg. She also compensates for their absence by increasing the intellectual factor in labour. Every town of 10,000 inhabitants has its technical school, supported by the municipalities. Look at Germany, which, though it does possess valuable raw materials, cultivates with assiduity the intellectual factor of production. In war and in peace her population is able to be used to the greatest advantage. Europe has scarcely yet recovered from its amazement at the sudden development of that empire, though it had been laying the foundation for its prosperity in the educational organization which she gave herself when the wars of Napoleon taught her the sources of her weakness. Now, surely we should not close our eyes, in insular pride, to the means taken by other countries to increase their productive resources. France fully admits that her recent calamities were largely due to a want of enlightenment of her people. She is still far ahead of us in technical institutions, but her general and university education are very deficient. If you desire an example of a country which cannot progress because of the ignorance of her people, look at Spain. When the Duke St. Simon, once French Minister there, said, "Science in Spain is a crime and ignorance a virtue," he explained in one sentence the cause of her misfortunes. A fertile country, washed by two great oceans, abounding in coal, iron, copper, and quicksilver, is unable to thrive because her people are ignorant.

The speaker then turned to the case of the institution whose formal inauguration had been the occasion of his address, and he proceeded, as a practical educationist, to give it and its projectors some advice.

Such colleges are likely to receive little support until the middle-class schools understand their duty to Society by making Science part of the effective instruction of youth. A port constructed for the reception of ships, before the ships themselves are built, has a dreary time to wait for their arrival, and so the managers of the new College must not be discouraged because it does not grow quickly.

Nor did he think it would be wise, at least in its infancy, to give to the College too much of a technical character.

Teach science well to the scholars, and they will make the applications for themselves. Good food becomes assimilated to its several purposes by digestion. Epictetus used to say that though you feed sheep on grass, it is not grass, but wool which grows upon their backs. What the College should aim at is to increase the science and intelligence of the community, and not to teach industries which they know a great deal better than the professors. The new College is only the local expression of a general movement for higher education. That movement has no doubt received its primary impulse from the conviction that our industrial population ought to be educated in the principles which underlie their occupations. But the object is higher than this. There is a desire to spread culture throughout the country, and not to concentrate it in one or two favoured localities. The older Universities are beginning to recognize this fact. Cambridge had made the bold experiment of trying whether, if the youth of the provinces would not go to her, they would receive educational missionaries sent to them. The older Universities could do much from their wealth and educational resources. They could easily spread enlightenment over England if they were earnest in the work.

No doubt our manufacturing and commercial classes require to be mellowed by culture, but our Universities must adapt that culture to the wants and spare time of busy communities. They cannot get hold of our great industrial centres in any permanent way unless they raise them in self-respect and dignity by giving them an intellectual understanding of their vocations, and upon that understanding they may engraft as much polite literature as they can. A college of science, such as we are inaugurating to-day, is admirable in itself, but it is not complete. Perhaps it even focuses the light too strongly on a particular spot, and for this reason it intensifies the darkness around. Its directors are too enlightened men not to see this, and I am sure they will aid in the co-ordination of your other educational resources. The ultimate effect of this may be that you may evolve a wider and more comprehensive college for higher education. I look to that time with hope, for differentiation of our colleges will be the best thing for learning and for vigour of intellect. Each great provincial town should have a college as a centre of intelligence, each a sun capable of warming and illuminating a region around it, not merely a moon to cast pale and cold beams as a reflection from a distant luminary.

Subsequent speakers, in so far as they went over

the same ground, merely ploughed with Dr. Playfair's heifer. The Marquess of Ripon was not discouraged by the small beginnings of the undertaking. All the experiences of the past showed that those institutions which had taken the deepest root, and which had flourished the longest and wielded ultimately the most extensive influence, had sprung from small beginnings. Our ancient universities had mainly sprung from individual effort, and from private endowment. We were not less wealthy than our ancestors who founded them. Surely we could do now what they did before us. He trusted that there was not to be any doubt as to the future of this institution. We were told that its managers had acted to a great extent upon faith; that they had been doing their work partly out of capital in the confidence that that capital would be repaid them by the good sense and generosity of their countrymen.

Of all those who followed, and who pleaded the cause of the College, none was received with greater heartiness and enthusiasm than Mr. W. E. Forster, and there was none whose speech had a deeper or more genuine note of sympathy and encouragement. There were perhaps special reasons for the warmth of the welcome with which he was greeted. The political circumstances of the time were peculiar, and Mr. Forster was known to be the undeserved victim of them. The Liberal party was then in opposition, and Mr. Gladstone earlier in the year had suddenly thrown up his position as its leader. Public opinion had designated Mr. Forster as one of the two or three politicians of eminence who might fitly be regarded as his successor. But a considerable section of the

Nonconformist Radicals never forgave Mr. Forster for his action—or what they supposed to be his sole action—respecting the religious question in the Education Act of 1870. Led by the Birmingham League, they were determined to make his selection as the party leader impossible. The League party in his own constituency of Bradford passed a resolution hostile to his claims. Eventually, rather that divide the Liberal party, Mr. Forster withdrew from the contest, and Lord Hartington, whom all sections were willing to follow, was chosen. These circumstances were well known to everybody in that large audience, and most moderate-minded men in it had the fullest sympathy with what Mr. Gladstone called "the thoroughly genuine and independent character" whose natural ambition as a statesman had been so rudely checked by the sectarian rancour of political allies. This was his reward for the wise and statesmanlike measure of 1870—one of the finest achievements to the credit of the Liberal party.

As he stepped to the front of the platform to make his contribution to the cause of the College he was received with round after round of applause, and for some minutes he was unable to proceed. Men instinctively recognized that the effort for which he pleaded was but another link in the educational chain which he had done so much to forge—the Endowed Schools Act of 1869 and the great Education Act of 1870. His was but a short speech, but each strong, vigorous utterance went home. The College was to be as its name implied—a county institution—not merely of the town in which it happened to be situated. They might as well at

once acknowledge that the call which had been made by civilization upon civilized people had not been so much responded to by England as it had been in some other countries. But they had awoke to the fact that a call was made upon them. They had a habit of being late, but not too late.

This demonstration had an immediate effect upon the fortunes of the College. One practical result was a considerable increase in financial support. Some of those who had already given, gave largely again; and many additional subscribers came forward. The existence of the College was made known throughout the length and breadth of the county. The Inaugural Ceremony met with a splendid "press." One of the most gratifying features was the "uplifting" tone of the speeches: speaker after speaker pointed out what should be the true character of the institution: it was not to be a mere Trade School—not simply a Technical College but a centre of liberal culture and of higher education, containing within it the potentiality of a University discipline.

To those who had ears to hear, and an imagination to conceive, the future of the College was plainly indicated within the first twelve months of its existence. It was this aspect of its destiny that appealed so strongly to that eminent journalist and man of letters, the late Sir Wemyss Reid, at that time editing the *Leeds Mercury*, and to which he gave emphatic expression in those forcible leaders so characteristic of his pen. So long as he remained in Leeds, Reid proved a staunch friend of the College and was ever ready to do what he could for its welfare. Nor was the educational press in

general at all backward in extending a welcome to the infant institution: certain members of the teaching staff did yeoman service in enlisting its interest and sympathy.

The result of this organized effort, in which all concerned—members of the Council, officers, teachers—worked with enthusiasm and unanimity, was seen in the record of the subsequent session's work.

From this time onward the successive Annual Reports of the College constitute an unbroken story of continued development. It was not, of course, surprisingly rapid, but it was steady and continuous. The progress of the institution was general; it was to be measured by the gradual increase in the number of its teachers, in the character and range of their subjects, and in the sessional entry of the students. It is, perhaps, significant of the change that a quarter of a century had made in the attitude of the middle class towards educational matters that the growth of the Yorkshire College, during its early years, should have been relatively far greater than that of Owens College at the corresponding period of its existence. But there may have been other factors to account for, or at least to increase, the difference. The generally acknowledged success to which the Manchester foundation had attained at the time of the establishment of the Leeds College may have been, and probably was, by the force of example and desire of emulation, a potent contributory cause.

The courses of study at Owens College, so far as circumstances and its means would permit, were avowedly based, at the outset, on the examples of

the older Universities. The little regard that was then paid to Science by the Trustees was indicated by the small stipend that was attached to the science chairs as compared with those on humanity subjects. There was no general recognition, even in the home of Dalton, of the beneficent part that science was able to play in the industrial life of the district. On the other hand, the Yorkshire College started wholly untrammelled by the traditions of ancient seats of learning, and its counsels were only remotely influenced by those who had been nursed in them. As its original designation implied, its projectors clearly recognized the value of science in relation to industry. They founded the College, indeed, in the strength of their conviction. They began, in fact, at a point to which Owens College had arrived when Roscoe made his influence felt upon its policy.

It cannot be said, however, that the educational aims of the governing body of the Leeds institution to begin with were very sharply defined; nor was the action of the Council always consistent. This was, perhaps, inevitable in a body which contained no professed educationists. Most of its members had everything to learn of the technique of education, and, as is not unknown in the history of similar institutions, it was some time before the Council could be induced to adopt formal means of availing themselves of the knowledge and experience of the academic element they sought to direct. At the outset there was no clear apprehension by them of the lines upon which the College should develop.

There were two distinct parties in the Council, and their views occasionally conflicted. The College

had been ostensibly founded to serve the industrial interests of the district, and the support of many of its wealthy manufacturers had been enlisted solely on that ground. This fact led a certain section of the Council to attempt to impress upon the College the character of an institute of technology. Whilst they were willing enough to extend its science side so long as it bore directly upon industrial needs, they had but little sympathy with the *literæ humaniores*, and all attempts to include such subjects were viewed with disfavour as a departure from the original intentions of the projectors. But the majority of the Council soon came to have a higher conception of the true functions of the young institution, and it was only the limitations of their means —their poverty, and not their will—that prevented them from attempting to realize their ideals. To this section the example of Owens College was, without doubt, a constant stimulus. It served eventually to direct the College upon the lines upon which it ultimately developed. But for a time this diversity of aim on the part of the government of the College made itself manifest with each attempt to enlarge its curriculum.

Fortunately the professoriate was of one mind on this question, and their unanimity was not without influence on the policy of the College. They recognized, of course, that there is no necessary antagonism between the two aims. Both should be developed *pari passu*: that is a condition demanded by modern necessities. It is the essential and characteristic feature of the higher education of the present time. The difficulty was to give practical

effect to these views under the restrictions imposed by the financial circumstances of the College. But the fact that the Staff held them and not only gave expression to them, but sought to realize them so far as lay in their limited power secured for the Professors the appreciation and confidence of the governing body, and ultimately obtained for them a responsible share in its counsels.

In the first few years of its existence several circumstances conspired to enhance the public reputation of the College and to consolidate its position. In its second session the teaching staff received a great accession to its strength by the appointment of Mr. Louis C. Miall as Lecturer in, and afterwards as Professor of Biology. Mr. Miall had already established a reputation as a man of science, as an able and attractive lecturer and a sound and experienced teacher. He brought to the aid of his colleagues a wise judgment and a knowledge of local conditions which under the special circumstances proved most helpful. His appointment at this period was not without its significance as an indication of the broad and liberal views which the majority of the Council entertained as to the scope and functions of the College. It was a wise policy to attach to its fortunes all who could in any way serve its true interests, whether in teaching, in enlisting public sympathy, or in the management of its affairs.

At the beginning of the following session (1876) the professors, who had now formed themselves into an Academic Board holding regular meetings in order to discuss the educational affairs of the College, addressed a memorandum to the Council inviting

them to consider the advisability of extending the curriculum so as to include Literature and Classics. They pointed out that they had frequent applications from students for advice as to obtaining the degrees of the University of London, or as to complying with the requirements for open science scholarships at the other Universities, but that, as at present constituted, the College was unable to afford the necessary facilities. They were of opinion that if the College were in a position to enable the students to obtain the science degrees of the University of London its usefulness would be considerably increased, and the wider curriculum might be expected to result in an augmentation of the yearly entry. The Council, on the whole, were not indisposed to consider the suggestion benevolently, but they regretted they were unable to take any action from lack of funds. The matter, however, was not allowed to drop. At that time Mr. Stuart and his syndicate at Cambridge were busy in their attempts to spread culture among the hives of industry, and their missionaries were at work in Leeds under the auspices of a committee of which the late Bishop of Truro (Dr. Gott), then Vicar of Leeds, and the late Sir Edward Baines, one of the truest and most zealous friends the College ever possessed, were active members. These gentlemen approached the governing body with a view of ascertaining whether some arrangement might not be possible whereby the work initiated by the University Extension Movement could be conducted by the College in a more systematic and permanent manner than hitherto, and they undertook on behalf

of the Committee to be responsible, for a term of years, for a considerable proportion of the money that would be required to give effect to the suggestion. The result of the negotiation was the establishment of Chairs of Classical Literature and History, and Modern Literature and History, which were filled, respectively, by the appointment of Professor John Marshall, M.A., of Balliol College, Oxford, afterwards Rector of the High School, Edinburgh, a distinguished classic, and author of an English rendering of the "Odes and Epodes of Horace," "Xenophon Memorabilia," and other works; and Professor F. S. Pulling, B.A. (Oxon). This enlargement of the educational work of the College necessitated a slight but significant change in its designation: henceforward it became known simply as the Yorkshire College until it was raised to the rank of a university, when it took the name of the town in which it was situated.

The executive of the College now publicly expressed their conviction that there is no good reason against grouping in one institution the studies belonging to liberal culture, and systematic instruction in scientific and artistic principles and methods as applied to staple industries.

An event of hardly less importance in public estimation at this period was the purchase of a considerable fraction of the site upon which the handsome and extensive buildings of the University now stand. The decision to take this step was one of the most momentous departures in the history of the institution, and the writer well remembers how seriously and with what anxiety it was discussed by

the small body which assembled in the office of the legal adviser to the College to confer with the Chairman of its Finance Committee on the subject. Mr. Francis Lupton, who at that period held the office, was an ideal custodian of its financial affairs. No man could be more prudent in their management: at the same time no one realized more fully that an ill-judged parsimony might be the worst form of economy, and that a timely expenditure might be the wisest investment. The two members of the Staff who were present at this interview, with the courage of faith and the enthusiasm of conviction, used their best endeavours to incline him to sanction what everybody who had knowledge of the financial condition of the institution could not but regard as a most onerous obligation. But in the end there was practical unanimity among those present as to the expediency and opportuneness of the step, and the event proved its wisdom.

The foundation-stone of the new College buildings was laid on October 23, 1877, by the Archbishop of York. As architect the Council had secured the services of the late Mr. Alfred Waterhouse, R.A., whose experience and success in the erection of Owens College seemed to them the highest possible qualification. By the generosity of the Clothworkers' Company, who had voted the sum of £10,000 for the purpose, the authorities were enabled to take in hand without further delay the buildings designed for the Textile Industries Department.

The publicity given to these proceedings greatly strengthened the position of the College in the county, and especially in the West Riding. These events

were no doubt such as must have come naturally and in the fullness of time, but their advent at this particular juncture was possibly accelerated by the action of Owens College in seeking for university powers. This movement on the part of Manchester had already engaged the attention of the Council of the Yorkshire College and was watched by them with no little apprehension. They realized that it was certain to have an important bearing upon the question of higher education in Yorkshire, both directly and indirectly, and that the future of the Yorkshire College was intimately bound up with it. It was therefore all the more necessary to prove to the world that Yorkshire men, in their own interests, were very much in earnest about their young institution; that they were determined to secure for it the fullest possible freedom of development and to extend and consolidate its position, unhampered by limitations to which it might conceivably be subjected by the presence of a relatively rich and powerful university close to its own area.

In the next chapter we purpose to indicate briefly the steps which led immediately to the foundation of the new university in Manchester and to show how the action of the Yorkshire College resulted in modifying its Constitution as originally contemplated.

CHAPTER V

THE VICTORIA UNIVERSITY

At the time of this movement in favour of the creation of a university in Manchester the writer of this memoir was, as already stated, a member of the teaching staff of the Yorkshire College, and was then, as for some years previously, in constant friendly communication with Roscoe. A letter informing him of the feeling in Leeds and the district concerning the action of Owens College, and the desire of the authorities of the Yorkshire College that its interests should in some way be safeguarded, brought the following reply under date January 31, 1877:

Thanks for the leader, which I had seen. What does Leeds want? A peripatetic university? First in Manchester, then in Leeds, then in Bristol, next in Newcastle? Or will it be content with an affiliation scheme? Do you want to come in *now*, incomplete as you are, or will you be content to wait till you are developed into more of a two- or three-sided sort of thing? How can the *unity* of an institution be kept up if all kinds and conditions of other institutions claim an equal voice in all the arrangements? In short, would it not be much better for Leeds, and Bristol and Newcastle, to have separate universities as well as Manchester, than to make a union in which there would not be strength? However, our proposed scheme will provide for the admission and representation of other places if they like to come in, but a university, like most other things, must not only have a name, but also a local habitation, and hence

I do not see how the idea of a wandering minstrel kind of university could possibly answer, and this is what, I take it, the writer of the article (who was he?) means. . . . I will send you a copy of our proposals as soon as they are settled.

After the special meeting of the governors of the Owens College, at which it was decided to take steps to obtain a university charter, Roscoe wrote to the present writer as follows under date March 27, 1877:

You may unofficially and on your own responsibility state to the Secretary of your College that you have reason to know that in the proposals to obtain a Charter to grant Degrees the authorities of this College have added a clause to enable other colleges, under certain conditions, to enter into union with the proposed University.

We were unable to accede to the request to forward the documents officially, as the Committee on the subject had not met. But you may say (privately) that it is the wish of those who are interested in the movement to make this admission of other colleges an essential part of the scheme.

This, to show your Council that their claims will be properly and fairly considered.

The following letter, dated December 5, 1877, was received after the Manchester deputation to the Duke of Richmond and Gordon, when the Lord President of the Council suggested some alteration in the government of the proposed university, which the memorialists considered and adopted.

At a meeting yesterday of the University Sub-Committee a more detailed scheme for the proposed Constitution was considered. I think you may like to know unofficially a few of the particulars, bearing in mind that it is simply as yet a proposal.

(1) The Charter to be granted to the Court of Governors of Owens College modified so as to give a somewhat larger representation of the Academical Element.

(2) The representation on the Court, when sitting for University purposes, of any other qualified College in union with the University to be as follows: the President, the Treasurer or Chairman of the Council; the Principal of such College; such proportionate numbers of (*a*) the Senate, and (*b*) the Governing Body of such College as may be determined by the University Court with the sanction of the Lord President of the Council.

(3) The Executive Body of the University to consist of members nominated by the Court and also, on the union of any other qualified College, the President, Treasurer, or Chairman, Principal and the members of the Senate of such Colleges nominated on the Court.

(4) The Court to be summoned for University purposes as distinguished from Owens College purposes by the Executive Body of the University.

Another point of importance to you is this: That power shall be given to the Court of the University, after considering the report of the Executive Body upon the subject, to accept the application of any other College for incorporation with the University, provided always that the Court should be satisfied: (1) that such College has established a reasonably complete curriculum and possesses a reasonably sufficient teaching staff in the Departments of Arts and Science at least; (2) that such College has furnished proofs of its means and appliances for teaching being established on a footing of permanent security; (3) that such College is under the independent control of its own Governing Body; and (4) that the admission shall receive the sanction of the Lord President of the Council.

Again, power to be given to any such College to appeal for final decision to the Lord President.

One other point. On incorporation the professors of such College shall take a proportionate share in all the examinations of the University as decided by the University Court.

I hope that these proposals will be found to meet your views.

Meanwhile the Council of the Yorkshire College, acting in conjunction with its Academic Board, had been carefully considering the situation. Influenced to a large extent, no doubt, by the local Press, public feeling in the district set strongly in the direction of immediate action. Although the infant institution

was barely three years old, there could no longer be any doubt that it was already firmly implanted in the estimation and regard of the community in which it was placed. Indeed, nothing in its short career up to that time stimulated and strengthened this regard more than this particular crisis in its fortunes. The call for sympathy and support which now was spread throughout the Ridings was the finest *réclame* it could possibly have. It served to deprive the College of the last semblance of being a merely local foundation; henceforth it was in fact as in name a county organization.

In the following May a deputation arranged by the Yorkshire College waited upon the Lord President of the Council. The report of the Council of the College pointed out that whilst the Owens College scheme admitted of the admission of other colleges to the university, the provisions that the charter should be granted to the Owens College, and that the university should be named after the City of Manchester were very generally considered incompatible with the future incorporation of institutions in other towns. Lord Ripon, in introducing the deputation, gave forcible expression to these views. The memorial was supported by representatives of the municipalities of the large towns in the West Riding and elsewhere in the county, by a number of scientific organizations, and by many eminent educational authorities.

As the Owens College memorialists had already expressed their willingness to consider favourably the inclusion of other colleges, under reasonable conditions, there was little difficulty in opening friendly

negotiations between the two Colleges with the desire on both sides to arrive at a satisfactory arrangement. The Duke of Devonshire, who was a liberal supporter of both Colleges, and had shown great interest in their welfare—Lord Frederick Cavendish being President of the Yorkshire College—convened a conference at Devonshire House between representatives of the two Colleges, when after full discussion the basis of a federal scheme was devised. The details of this were worked out by committees of the two Colleges. Eventually complete agreement was arrived at, and it was decided to present a joint memorial from the two Colleges praying that Her Majesty might be advised:

(1) To create a new university, in which the Owens College, Manchester, and such other institutions as may now or hereafter be able to fulfil the conditions of incorporation laid down in the Charter, may be incorporated colleges.

(2) To grant to each of such incorporated colleges a share in the government of the university, depending only upon its magnitude and efficiency, in accordance with the suggested Constitution.

(3) To be graciously pleased to allow the said university to be called the Victoria University.

In the various conferences needed to reach this solution the late Sir Arthur Rücker, who acted as one of the representatives of the Yorkshire College, took an active and leading share, and it was in no small degree due to his tact, urbanity, and diplomatic skill that it was secured.

In reference to this matter the present Master of Peterhouse, Sir A. W. Ward, who was at the time

The Right Hon. Sir Henry E. Roscoe Principal of the Owens College, bears the following testimony:

"I remember very well how admirably he conducted the case of the Yorkshire College, which was at first adverse to our wishes at Manchester, and afterwards was conjoined with our own application. He had great difficulties to contend against; for the Yorkshire College seemed to be opposing our application for a university charter without being able to set up a similar claim for itself, and the federal principle to which resort was ultimately had was by no means free from objections. He had, if I remember right, very effective parliamentary support, especially in the late Mr. W. E. Forster, and then, or afterwards, in the late Lord Ripon. But he was the active representative of Leeds, and the virtual success of the action of the College was very largely due to him.

"Personally he was a man of great charm of manner and a very pleasant as well as effective speaker."

The deputation presenting the joint memorials waited upon the Lord President, who was accompanied by the Marquis of Salisbury, on May 5, 1879. It was headed by the Duke of Devonshire, as president of the Owens College, and the Archbishop of York, as representing the Yorkshire College, and consisted of noblemen and gentlemen of influence connected with the two counties; representatives of different denominations, municipalities, scientific and educational bodies, as well as other gentlemen interested in higher education. It received the customary promise "that the proposal should have the most attentive consideration of Her Majesty's Government."

The Victoria University

The various steps in the procedure needed to obtain a royal charter are many and devious. They need only be indicated by stating that they seem expressly designed to afford abundant occupation for lawyers. The following letter from Roscoe, sent to the writer from the Athenæum Club, and dated June 19, 1879, bears upon this point:

> It is most important that you should at once get a Petition to "The Queen in Council" drawn up and sent to the Parliamentary Agents for presentation. We are doing so. The Duke of Devonshire will sign our petition, and yours in identical terms should be signed by the Archbishop [of York] and Lord Frederick Cavendish.
>
> . . . . . .
>
> The Council meets on the 26th June, and everything must be sent in before that date.
>
> I have seen Mr. [W. E.] Forster who has telegraphed to your secretary this evening.
>
> We have the draft of our petition at O[wens] College if you wish to consult it.
>
> It is most important to get this done and to get your Archbishop to sign.

The next letter, so far as regards the Victoria University, requires some explanation. The then Chairman of the Council of the Yorkshire College, the late Dr. Heaton, was not wholly friendly to the idea of a new northern university, and ultimately he dissociated himself from his colleagues on this particular question. He was never able to persuade himself that another university was actually needed or was desirable. In his judgment the interests of higher education, so far at least as the creation of degree-granting bodies could serve them, were sufficiently assured in England by the existence of the universities of Oxford, Cambridge, and London. He

viewed with considerable apprehension the attempt to establish rival universities: he imagined that the stress of competition for students might lower the standard of scholarship. Above all he was strongly opposed, in what he thought the true interests of the medical profession, to the increase in the number of possible avenues to practice: in his opinion there were already too many for an efficient standard of qualification to be maintained. It was perhaps characteristic of him to suppose that the immediate, and indeed the ultimate, effect of the establishment of the university in Manchester would be not to hearten and rouse his colleagues to fresh exertions in order to make the Leeds College worthy to be received as a member of the University: on the contrary, he thought that, by force of circumstances, the enthusiasm of the friends of that institution would be gradually damped, and their energy proportionally weakened, as the neighbouring College grew in power and prestige after being raised to the dignity of a university. He was specially concerned about the future of the Leeds Medical School, of which he had been a member for many years. It was well established and had an excellent record, but its position would, he considered, be undermined and its continued existence jeopardized by the proximity of a school attached to a degree-giving body. He was not able to carry his colleagues on the Council of the Yorkshire College with him in his view of the probable influence of the new University on its fortunes. As the sequel proved, he entirely misconceived its effect: so far from weakening the energies of its friends, events showed that it acted as the most power-

ful stimulus the Leeds College ever received. But Dr. Heaton's authority and influence with respect to the Medical School enabled him to carry his point in regard to the proposed medical degrees, and the Yorkshire representatives were instructed to disavow any wish that power should be sought to grant them. A suggestion to send a private message to the Lord President to this effect was made after it had been represented by the legal agents that no observations on the draft chapter could be received by the Privy Council. Under the circumstances the authorities of Owens College were not without justification for their disappointment and annoyance.

In the first place I would propose to you that we should together do the atomic weight of Titanium. You and I both thought of doing it. You are busy with other things. . . . I will sketch a method out, prepare some more $TiCl_4$ and send the proposals to you. If you like, that is. So much for private affairs.

Now with regard to the Victoria University. We all have been much annoyed and surprised to find that you at Leeds, having so far acquiesced in our proposals—see memorial, etc.—now at the last moment put in a *caveat* about Medical Degrees! This appears to us rather too bad. If this move was intended we ought to have had previous information of it. If you have only now determined on this course it is more obviously unfair to us to start the hare now! Fancy what the University will be without such power. Think of Glasgow and Edinburgh thus emasculated. Is this what you wish us to come to?

Then I think that R.'s proposal to send a private message through your President to the Duke of Richmond still more objectionable. "Openly we agree, but we come to inform you privately that you will please us by striking out the provision." This is really what you propose to do! This, coupled with the petition from Liverpool and the opposition and jealousy of other Medical Schools, may suffice to so mutilate our Charter that it won't be worth having.

Do see what can be done to dissuade your people from sending any such message to the Duke.

The private message above referred to was not sent. At the same time Dr. Heaton's views, backed up as they were by the action of the College of Surgeons and British Medical Association, and a great number of the leading hospital surgeons and teachers in London and elsewhere, prevailed, and the application for power to grant degrees in medicine and surgery was, for the time at least, withdrawn, in the expectation that legislative action on the general question of medical education and qualification was contemplated. As no such action was taken, a supplementary charter removing the restriction was granted on April 20, 1883.

The next letter, under date February 14, 1880, shows a further stage in the progress of the application. By a then recent Act it had to be laid before both Houses of Parliament for thirty days before any report on the subject could be submitted to the Sovereign.

. . . . . .

By the way, you know, of course, that the Charter (unaltered) is now lying on the table of both Houses, and if we can only keep everybody quiet it will be law in less than thirty days!

When are you coming over?

The Charter was granted by the Queen in Council on April 6th, and was finally ratified on April 20, 1880.

The next letter (March 30, 1880) shows that this event was to be celebrated, as a matter of course, in the customary British method.

I am very sorry that you cannot dine with the P.C.S. [President of the Chemical Society—Roscoe himself] on the 16th. I intended you to have been there as Longstaff medallist! I am asking the officers and some of the Council.

The Victoria University

You must all reserve yourselves for July 14th or 15th. The opening of the V.U. [Victoria University] and a Banquet at the Town Hall!!

The following letter (January 16, 1881) shows how cordial the relations between the sister Colleges had now become, thanks to the frank and friendly discussion between their representatives, and how loyally those in authority at Owens were prepared to carry out the compact:

Accept my sincere though tardy thanks for your beautiful photograph, which is a marvellous study of volcanic action.

I have lately heard that P—— has been making a statement (on whose authority I cannot think) that the Yorkshire College would not be allowed to join the V.U. Though I know that you would take this for what it is worth, I think that others may misunderstand, and I think that you should inform any one who reports such a statement that it is wholly without foundation. In the first place, the V.U. cannot refuse even if they desired to do so. In the second, I for one, and many with me if not *all*, will cordially welcome any addition to ourselves, for those who have to work the new University desire to have other competent persons to help to share their great responsibility.

Roscoe, in fact, from the very beginning of its career had always shown a sympathetic interest in the fortunes of the Yorkshire College. Badly housed and poorly endowed at its start, its early struggles and difficulties were watched by him with a kindly regard, based, no doubt, to some extent on the memory of his own experiences. He was not unfrequently in Leeds in those days, and his breezy optimism and cheerful confidence that things would come right, in spite of checks and disappointments, were at once stimulating and encouraging to the small band of young professors who were striving to mould

the institution according to the pattern of that which he had himself done so much to fashion. An indication of that interest was manifested by his presence, in December 1880, at the formal opening of the new buildings which the College owes to the wise liberality of the Clothworkers' Company. At the banquet which followed he responded to the toast of "The Victoria University," and expressed, on behalf of the authorities of Owens College, the hope that before long the Yorkshire College would become one of the incorporated Colleges, and would help the Owens College to uphold the dignity and usefulness of the new University.

Roscoe took a leading part in shaping the curriculum of the new University, and at the meeting of the Court which settled its general lines he might be said to have been the mouthpiece of the party which succeeded in impressing upon it its characteristic features. What had to be considered were the needs of great industrial communities. What sort of knowledge do they desire, and what should they be encouraged to pursue? The discussion mainly turned upon the place which the classical languages should hold in the university courses. "Compulsory" Greek was no longer regarded as a practical question. Should "compulsory" Latin also be eliminated? Are these ancient languages, or either of them, still to be regarded as an indispensable part of a liberal education and an indispensable requisite for a degree? The claims of the Classics were not without defenders, but as a local newspaper pointed out in a leading article, curiously enough it would seem that among the stoutest of these were to be found some

of the very men who might have been supposed to be the natural champions of the newer learning and if orthodox academic traditions received a rude blow, it was because they were deserted by the very men who had been nursed in them. With two exceptions, the professorial members of the Court were unanimous in recommending that Latin should not be made obligatory for a degree. The Chancellor and Lord Derby supported the contention that whatever may be the value as mental food and training of the Classics when thoroughly mastered the wretched minimum of ill-learnt Latin and soon forgotten Greek prescribed in university examinations as preliminary to more serious studies possesses no educational value whatever. Perhaps the argument most decisive with the Court was that given by Roscoe. He said they had to consider the large number of persons who came to the Owens College for special instruction, and more particularly for engineering and mathematics, but who had never been at any school where Latin was taught. Those were the men who carried off the best engineering prizes, and for them it was that this door had wisely been kept open. They must not be guided by what Oxford or Cambridge had done, but by what was good for their own district and what was advisable at the present moment. Let them remember what a number of men such as he had mentioned there were in their neighbourhood, and how flourishing were the mathematical schools, and then let them say whether they could cut off those schools and men from university education. The "innovators" won the day by a majority of 2 to 1, and thus effected "the

dethronement, never to rise again, of this mischievous idol."

It was amusing to notice the perturbation which this departure from a time-honoured tradition caused in certain scholastic circles and among the self-styled "friends of culture." But on the whole the action was favourably commented upon by the more influential newspapers and leading educational journals. It was regarded as the inevitable consequence of modern necessity, and of the gradual recognition that the traditions of mediæval schoolmen were not sacrosanct or necessarily the best adapted to new requirements.

In drafting the Constitution of the new University power was of course taken in accordance with established procedure, and in deference to the democratic tendencies of British seats of learning, to form the body known as Convocation, and those of the former students of Owens College who came within certain definitions were made its first members.

It would seem to be the inevitable tendency of all Convocations to play the part of a Parliamentary Opposition. Their primary duty, as they conceive it, is to criticize and to take an independent view of the policy of the university, as determined by the governing or executive powers. No doubt such criticism is salutary if wisely directed, but experience has shown that it is sometimes factious and occasionally obstructive. Much, therefore, depends upon the chairman. It was felt by many of the members that it was specially important at the outset to make a prudent selection if Convocation was to secure from the beginning its proper influence and dignity as a

deliberative assembly. The Extreme Left—there is always such a group in such a gathering—had promptly proposed Dr. Richard Marsden Pankhurst, a student of the College in the Quay Street days, and now mainly remembered as the husband and father of certain ladies who have distinguished themselves in the cause of Woman Suffrage. Dr. Pankhurst was never regarded quite seriously in College circles—least of all by his former associates, who on a dull evening at the Union would occasionally put him up to make a political harangue in the style of the Convention, when he would declaim the most blood-curdling sentiments in a highly pitched falsetto, with all the fiery eloquence and fervid passion of a Danton or a Hebert. But however powerful the appeals to a youthful enthusiasm, the stones of Quay Street remained unmoved, nor was Deansgate at any time blocked with barricades.

Later on Dr. Pankhurst went to the Bar, when he followed in the footsteps and sought to better the example of a once well-known Chartist orator whose name is well-nigh forgotten, became an active local politician, and made one or two futile attempts to gain a parliamentary seat as the most extreme of advanced Radicals. It was possible, of course, that when weighted with the responsibilities of office Dr. Pankhurst's conduct of the chair might have been irreproachable. But the majority of Convocation were not disposed to take the risk. Accordingly an "influentially signed" memorial was issued suggesting Roscoe as first chairman. The advantage of securing at this early period a chairman well acquainted with the work of the other

co-ordinate bodies of the University was obvious. But there was another reason, as the terms of the memorial indicated. The general body of the members were anxious to testify their appreciation of the services of the man who had been so largely instrumental in making a Convocation at all possible.

By knowledge and experience no man was more qualified to promote administrative accord than Dr. Roscoe. From him came the first proposal of the new University; and no one worked with greater zeal and devotion in the movement, which after a long struggle was so happily successful. No sacrifice of time and labour was too great for him, and his forethought and knowledge of business were of untold advantage during the negotiations.

The suggestion that he should be the first chairman was made without Roscoe's knowledge, but it was so well received that he consented to be nominated and was elected by a large majority. The *Intransigeants*, of course, affirmed that they were fighting solely for a principle, and "as a protest that those who teach and train ought not to govern and examine and fill all the positions in the University." They next proceeded to move "a kind of vote of censure on the Executive Council for anticipating the jurisdiction of Convocation in arranging for degrees, examinations, and so forth." This was met by "the previous question" and lost, whereupon the meeting proceeded to discuss the absorbingly interesting subject of academic costume, and the dissident minority melted away.

At this first meeting the clerk informed Convocation that at the next ordinary meeting of the Court the Council proposed to report as to the University making use of its power to grant degrees to persons

being at the date of the University Charter associates of the Owens College. The first graduation ceremony of the University took place in the autumn of 1882, when Professor Ward in presenting the Associates said:

The Associates of the Owens College, whom it is my privilege to present to you to-day, are spontaneously linking their names and reputations with the name and fame of our University, and it seems a twice-blessed relationship which on both sides is founded on goodwill. Many of those whom I am about to lead to you are men distinguished in letters and science, and in the several learned professions and other occupations to which their lives are devoted. Some are members of the governing and teaching bodies of our own University. A great number hold the degrees of other Universities —of those older Universities from which our own has received so many signs of kindly and ready sympathy, or of that great examining University without which much of the educational progress of the last half-century—without which such progress as was made within the walls of Owens College, would itself have lacked its trustworthiest tests.

The following letters from Roscoe to the writer have reference to this function, which took place in the Manchester Town Hall—with, as the descriptive reporter stated, "all the ceremony and pageantry that help to cast a glamour over the older seats of learning."

MANCHESTER,
October 14, 1882.

I write a line to say how much we all hope that you will run over on November 1st to have the degree of the V.U. conferred upon you. It is of importance that our best Associates should show up on the occasion, and I am particularly anxious that you should not be wanting. The ceremony is to be held in the Town Hall, and we hope that Lord Derby and Mr. Mundella will be present.

How are you getting on? We are full in our laboratories and hard at it.

. . . . . .

Unfortunately, the recipient of these letters (and of the degree) was unable to be present. He had just succeeded by effluxion of time to a position formerly held by Roscoe himself in "that great examining University" which had in the past so efficiently tested the educational progress of Owens College, and his official duties kept him in London.

October 22, 1882.

I think in spite of Mrs. A. B. B.Sc. it would be as well if you would come to have the V.U. degree granted. If you do not come, unpleasant remarks may be made as to the cause of your absence.

I never supposed you did care for the degree as a degree: it is simply an enrolment of yourself as a *bona-fide* member of the University. . . . My feeling is that all those who have an interest in the University and who have taken active steps in its foundation should not hold aloof on this occasion, but show that they are willing and anxious to support the new University to the best of their power.

You took an active part in modifying the original lines on which we had decided to lay our University, and I think that therefore you are, perhaps, more bound than other people to help now to make it a success on its present footing. . . .

I am very glad you are coming to open our Chemical Society's Session here on Friday. I fear I may be away as my Commission [Technical Instruction Commission] meets on Wednesday for some consecutive days. If I can get back I will.

The time, perhaps, has not yet arrived to attempt to assess the effect on the higher education of the country which has followed from the establishment of these modern universities, but that it has already been very great there can be no question. Since they are free, for the most part, from the influence of the schoolmen, and are unhampered by mediæval traditions and the prepossessions of the past, they are the more readily able to shape their course in

accordance with the demands of industrial progress and the necessities of modern life. From the circumstance that they are nearly all situated in large towns and in the midst of industrial communities, the study of science is, as a rule, a prominent feature in their scheme of instruction, and accordingly their science faculties are usually strongly developed. A spirit of emulation makes them all active centres of research, especially in physical science and in its technical applications, and their aggregate output of original scientific inquiry is now very considerable, and in extent and quality compares most favourably with that of continental nations. Their influence upon the conduct of those industries which ultimately depend upon science is already very marked, and as the number of scientifically trained men becomes larger, as the result of their instruction, that influence is bound to become still greater. With the diffusion of a knowledge of scientific principles new applications of science to practice will follow, and these in their turn will react upon the instruction in the schools of science. The ultimate effect of all this will be a still clearer recognition by the community that the permanence and eventual success of our manufacturing industries depends upon the intelligent application of science.

We are thus able to perceive how Roscoe's action in helping on the development of Owens College on modern lines and in raising it eventually to the status of a university has reacted, and is bound still further to react, upon the intellectual and material welfare of this country. It was the great success of the Manchester College as a centre

for the diffusion of knowledge in its own district that incited other towns to seek to emulate its example, and when Owens College sought for the position as a university to which she was entitled, the same spirit of emulation quickened the efforts of her friendly rivals to make themselves not less worthy of such a dignity.

Of course it is not claimed for Roscoe that he actually initiated this remarkable movement—a movement which must be regarded as one of the most significant features of our times; he shares the credit with others. But he certainly was one of the mainsprings of it. It may be said the time was ripe for the step. Nevertheless, it is due to him to affirm that he was one of the earliest to perceive that fact, and to take occasion boldly by the hand. If he cannot justly be said to have actually started the action, he was at least one of its most powerful prime movers.

CHAPTER VI

ROSCOE AS A TEACHER

SOME years before Owens College attained to the position of a university, several attempts were made to induce Roscoe to sever his connection with it. In 1870 he was offered the lectureship on Chemistry at St. Bartholomew's Hospital in succession to Dr. Matthiessen.

The following letter under date October 14, 1870, refers to this circumstance:

. . . . . .

I have just refused to go to London again! They wanted me at St. Bartholomew's.

Miller is to be succeeded by ————, and it appears that this gentleman has made a compromise with the New School, and is to adopt O = 12! Is not this rich? Originality at King's was always at a discount, but then Orthodoxy reigns supreme, and this is the "Wahre Jakob," as they say in German!

Lockyer is down here visiting Stewart, and I had a physical and astronomical party here last night (my wife being away), at which a large number of interesting new observations on the heavenly bodies and on science in general were made, which did not conclude until the small hours.

I cannot buckle to the new book—but I have arranged the order of things to my tolerable satisfaction. Whether it will ever see the daylight remains a mystery. . . .

Two years later he was invited to become a candidate for the vacant chair of Chemistry at

Oxford, with the promise of a fellowship if elected. That he might be Brodie's successor was, he says, a tempting suggestion, but on consideration he felt he had a wider scope, and the possibility of greater usefulness in building up the chemical school of Owens College—a decision which he had the satisfaction of knowing met with the warm approval of Huxley and other friends.

Roscoe's method of working his department was wholly modelled on that of Bunsen, as those of his pupils who subsequently repaired to Heidelberg could testify. *A bove majori discit arare minor.* He gave his lectures at the beginning of the working day, after which, and whilst the laboratory men were settling to work, he would retire to his sitting-room to glance at his correspondence. He would then go round to each in turn, see what had been done since the previous visit, and give such directions and advice as were necessary. Although the students worked independently, and were at different stages of progress, he knew precisely how each was occupied. With the men engaged on research work, or with preparations, or on any matter out of the usual routine, he would frequently spend a considerable amount of time. He always seemed to be as much interested in the work as the workers themselves, and was unaffectedly pleased with a good analytical result, a well-constructed apparatus, or a neat preparation. His boyish love of manipulation, simply as such, remained with him to the end, and he somehow managed to convey something of his own feeling of delight in handling apparatus to those he taught. In this lay the secret of his power and

success as the director of a laboratory. Although his students never forgot that he was the professor—he was always "Doctor" Roscoe to them—they realized that he was quite on an approachable plane, and a bond of sympathy and of mutual understanding was quickly established which strengthened into friendship and esteem.

As a teacher, tolerant of the imperfection of human nature in youth, he might pardon stupidity or condone carelessness, but he had no patience with anything that savoured of pretension or deceit. Nothing angered him more than to find that an analytical result had been "trimmed" or "cooked." He once summarily expelled a young man from his laboratory who, under pretence of making a re-determination of an atomic weight, was caught hatching out a series of wholly fictitious numbers. And he was amazed at the mentality of a minister of religion who failed to perceive the heinousness of such a crime, the fact being the good easy man thought the procedure was on a par with any other mathematical exercise, and therefore liable to error. That young man, it may be added, in after years came to a violent end, for he was lynched for horse-stealing; the descent to Avernus, as Roscoe would point out, is easy and inevitable to one of the moral obliquity that can juggle with the sanctity of experimental figures.

The ingenuous youth of Owens in the writer's time were not a particularly lamb-like lot, and occasional *émeutes* were not unknown, but disturbances in Roscoe's class-room were absolutely unheard of. Indeed, such was his personal ascendancy that at times his assistance was invoked to quell an uproar in a

neighbouring territory. As he stepped into the room and began, "Now, boys, etc.," he would be received with a round of cheers, and order would once more reign in Warsaw. A word of expostulation from him would suffice to ensure it.

Of course, as the number of his pupils increased, and the laboratories became larger and more numerous, it became impossible to give so great a share of individual attention, and much had to be delegated to demonstrators, for the most part chosen from among senior students who were preparing for an academic career, and who had themselves been trained by him. At the same time he was quite alive to the value of "new blood," and any promising young man who had shown aptitude for teaching or ability in research was sympathetically considered on the occasion of a vacancy.

He next visited his private laboratory to consult with his assistants, and to learn how their work was progressing. As his engagements multiplied, and the calls upon his time increased, he gradually ceased to take any active part in the operations when assured of the competence of those to whom he had entrusted the execution of his plan of research. Indeed, he allowed his chosen helpers considerable latitude, if, as usually happened, they were genuinely interested in their work. He had a strong belief in the wisdom of giving the 'prentice hand "his head," as the surest way of strengthening any latent faculty for original inquiry he might possess. He had himself been trained in this way, and he employed the same methods in turn.

Roscoe as a Teacher

Roscoe, like Bunsen, set no very great value on lecture-room teaching, although he recognized that with the majority of students no other system is practicable. It no doubt serves to afford an *aperçu* of the subject, which is what the average attendant at lectures presumably wants. At the same time he spared no pains to make his lectures interesting, and they were always admirably illustrated by experiments. Luckily he had in his *famulus* Heywood, a remarkably able lecture-assistant, a skilful glass-blower, and a good mechanician, with a talent for devising striking and original illustrations. Roscoe had a good voice, clear enunciation, and a pleasant, easy mode of delivery, but he had none of the arts of the orator—nothing of the fiery, impulsive manner of his contemporary, Hofmann, or the command of polished speech that characterized Kekulé. In the lecture-room his language was simple and direct; he was an excellent expositor, always lucid, occasionally humorous, and never dull.

Although organic chemistry at his most active period as an investigator was experiencing an extraordinary development, and offering limitless opportunities of discovery, its problems then, and, it may be added, at no subsequent time, had more than an academic interest for him. The only communication dealing with organic chemistry with which his name is associated is a short note on the Spontaneous Polymerisation of Volatile Hydrocarbons contributed to the Chemical Society in 1885.[1]

[1] "Note on the Spontaneous Polymerisation of Volatile Hydrocarbons at the Ordinary Atmospheric Temperature." By H. E. Roscoe. *Chem. Soc. Trans.* XLVII. (1885), pp. 669–671.

The paper had its origin in a chance observation brought to his notice by a tar-distiller, who had noticed the formation, on standing, of a white crystalline mass among the volatile hydrocarbons resulting from the decomposition of phenolic substances at a red heat. The crystalline substance was found to have a molecular formula $C_{10}H_{12}$, but its real nature and the mode of its genesis were not established.

Organic chemistry was hardly taught at Heidelberg in Roscoe's time, and then only by subordinate professors and *privat-docenten*, mainly to pharmacists. The effect of this training was seen in the subsequent character of his teaching. The lectures on organic chemistry that he was necessarily required to give at Owens College, with their limited possibilities of experimental illustration, simply bored him. Happily he found in Schorlemmer a colleague who was glad to relieve him of the duty. Schorlemmer was not a fluent speaker, and although he wrote our language with ease and accuracy, he never acquired familiarity with the mysteries of its pronunciation. But he was an excellent teacher, remarkably well-read, and had an astonishingly retentive memory, and his lectures were thoroughly appreciated by the discerning student.

Roscoe continued to direct the Chemical Department of Owens College until his election as Member of Parliament for the Southern Division of Manchester in the autumn of 1885, when he resigned the Professorship of Chemistry. On his retirement the Council recorded its strong sense of the eminent services he had rendered to the College through a period of thirty years, and its conviction that to his

great attainments as a man of science, his skill and success as a teacher and organizer, his widespread reputation, and his high personal qualities, it was in great measure due both that the College enjoyed so high a rank as a place of education, and that its Chemistry Department in particular had long held a position second to that of no other academic institution in the United Kingdom.

Similar testimony was borne by his colleagues when placing his portrait by Burgess in their Common Room, and by his pupils when offering another portrait by Herkomer to Lady Roscoe. The address accompanying this latter gift, and signed by upwards of two hundred old pupils, was as follows:

To Sir Henry Enfield Roscoe, M.P., D.C.L., LL.D., F.R.S., etc., Emeritus Professor of Chemistry in the Owens College, Manchester, February 16, 1889.

We, the undersigned students of the Owens College, who have had the privilege of being your pupils, desire at the close of your active work as a teacher to offer you some recognition of the value of the services you have rendered to your College during the time you have laboured as one of its professors. For upwards of thirty years you have had the control and direction of the chemical department of the Owens College. You leave it the best organized and best equipped school of chemistry in the kingdom, numbering its students by hundreds, and the acknowledged model of the many similar institutions which the success of your own school has called into existence. No place of chemical instruction in the country has exercised so profound an influence as that of which you have been the moving and directing force, and with which your name will always be connected. Its influence on the industrial welfare of the community is seen from the number of responsible positions held by your students in the district. Its influence on educational progress may be judged from the number of your pupils who hold important positions as teachers of chemistry. As a centre of chemical research you have made the Owens College known all

over the world, and your books on chemical science form the standard works, not only in this country, but in many others. The genial and sympathetic interest which you always showed in the lives and work of your students is gratefully remembered by all of us, and it has bound us to you by a personal tie such as rarely unites a teacher and his students. Whilst we have viewed with regret the severance of your active connection with the institution for which you have done so much, both in moulding its academical organization and in consolidating its work, we trust you may long be spared to continue in the wider sphere of political and public life those efforts which have already contributed so largely to the intellectual advancement of the people of this country. We beg your acceptance of the portrait which accompanies this address as a token of our affectionate respect, and in grateful recollection of many kindly acts which have endeared you to us all.

In a short account which Roscoe compiled for private circulation, he recorded, with pardonable pride, the rise and progress of the Chemical Department of the Owens College during the thirty years he directed it; and he indicated the leading principles which had guided him in its development. He recalled the position of the College in 1857, when the workers in the chemical laboratory were fifteen in number. It was only very slowly realized that Science could be made an efficient instrument of education, and that such an education was not only compatible with, but was absolutely necessary for, a successful manufacturing and industrial career. The fact that the stipend of the Professor of Chemistry was fixed at one-half of that given to the other chairs showed how the Governing Body at that time regarded the relative importance of that subject, as compared with classics and mathematics.

From the outset he was firmly convinced that the great blot in English industrial life was a singular

want of appreciation of one of the essential conditions of success, namely, a sound training in the scientific principles which underlie all practice. The fact that the intimate connection which ought to exist between science and practice was more clearly recognized by our continental rivals, was bound in the long run to tell against our own manufacturing industries. He then shows how he had sought to establish a sound and thorough course of systematic theoretical and practical instruction in chemistry to meet the gradual recognition of this fact which he was certain would arise under the stress of necessity. But, as he points out, the success of any such scheme must ultimately depend upon its director.

The personal and individual attention of the professor is the true secret of success; it is absolutely essential that he should know, and take an interest in, the work of every man in his laboratory, whether beginning or finishing his course. . . . It is in the laboratory, and there alone, that chemistry can be properly learnt, and it is by the peripatetic teaching of the professor and his demonstrators that the student benefits most. Laboratory teaching must inculcate method and accuracy; the student must be made to understand what he is doing and why he does it, and must gradually acquire the power of exact observation and of logical inference. All these faculties are exercised and developed by a properly organized and thorough course of qualitative chemical analysis, and no elementary course of practical scientific work is more useful, either in training the hand or the head.

This, however, presupposes that an explanation of the theory accompanies the practice of qualitative analysis, and that the student attends a course of instruction in which the reactions and methods of separation are systematically explained and discussed, as well as a general course on theoretical chemistry.

Having thus obtained a knowledge of the principles of the science, facility in manipulation, and reliance on his own powers of observation, the student should begin quantitative analytical work, in which he learns by degrees what scientific accuracy means, and

how exact results are to be obtained by careful work. Constant personal supervision of the student is absolutely requisite, as everything depends on the care with which the various operations are carried on, working from recipes without superintendence being really valueless. One main object of this course is so to teach the pupil as to give him reliance on his own power of exact work; to inculcate habits of neatness and order; to make him aware of sources of error, and to teach him either to estimate their amount, or how, if possible, to obviate them.

On this firm foundation of a competent theoretical knowledge of inorganic and organic chemistry, and of a thorough practical acquaintance with analysis, can alone the proper and higher education of the chemist, whether for purely scientific or for technical purposes, be based. It was upon this view Roscoe consistently acted. He steadily set his face against any practising of rough-and-ready works-methods until the student had learnt to appreciate the exacter processes. It is only when he has gained the capacity for judging as to the particular applicability of a method that he should be permitted to compromise between efficiency and speed. When confidence is based upon knowledge and practice, the special circumstances of his position and his sense of responsibility, when engaged in technical work, will enable him to determine rightly when such compromise is justifiable.

As regards instruction in applied chemistry, Roscoe always held that the application can only be properly learnt in the factory or works, just as a trade cannot be taught in a school—unless, indeed, the school becomes a shop. But there is no reason why the scientific principles and details of the various industrial processes should not be brought to the knowledge of the pupil who is intended afterwards to conduct

such processes. Provided a sound scientific basis is secured, such instruction, given by a teacher who has had practical as well as theoretical experience, is of great value to the technical student.

Thanks mainly to Roscoe's example, these principles are nowadays among the commonplaces of chemical instruction, and are adopted substantially by all teachers of experience. That they commended themselves to lay minds capable of appreciating and judging them, and that the practical results of working the Owens College Chemical Department by means of them proved satisfactory, was proved by the steady increase in the number of Roscoe's pupils, session after session, and by the variety of responsible and important positions many of these pupils subsequently filled. Another significant feature was the increasing public recognition of the meaning and value of a sound chemical education as shown by the growing willingness of parents and of young men themselves to devote such an amount of time to their studies as would enable them to obtain real benefit. He found in the earlier years of his experience that the prevailing notion of the majority of manufacturers (though there were notable exceptions) was that if the son stayed at College for six months he could be "put up" to all the necessary information to enable him to apply chemistry to his business.

The fathers (he said) frequently used to come with a story of this kind: "I am a calico-printer, or a dyer, or a brewer, and I want you to teach my son chemistry so far, and only so far, as it is at once applicable to my trade," and when informed that chemistry as a science must be taught before its applications could be understood, and that his son could not for two or three years at least begin to work upon the subjects directly bearing on his trade, he

too often replied that if that were the system he could not afford time for his son to learn on this plan, and that if he could not be taught at once to test his drugs he should prefer to leave him in the works, where he and his father before him had made a great many commercial successes with no scientific knowledge, and where he saw no reason to doubt that his son would do the same. The change that has come over our manufacturers during the last five and twenty years [this was written in 1887] has been remarkable, and now all are, I believe, fully awake to the necessities of their position, and are most desirous of improving the scientific knowledge not only of themselves and their sons, but of their managers, foremen, and workpeople. That this is so may be proved by the fact that whereas formerly it was difficult to keep our students for more than one session, we now find our senior laboratory well stocked with men in their third, fourth, and even fifth years, working at advanced subjects and becoming "chemists" in the highest and best sense of the word.

When he laid down his office he could point to the fact that his laboratories, spacious as they were thought to have been when first erected, had been more than full during the previous half-dozen years. It was calculated that upwards of two thousand men had passed through his courses. Among them were many teachers, technologists, and professional chemists occupying responsible and important positions. In the list of the Dalton Chemical Scholars, and of the Berkeley Fellows, were to be found names known in the literature of science for their scientific investigations. Indeed, no similar place in the kingdom could show such a record of contributions to chemical knowledge. Under Roscoe's government the Owens College Chemical Laboratory furnished, from first to last, two hundred and thirty-five original communications, mainly to the *Journal of the Chemical Society*, or the *Proceedings* and *Transactions of the Royal Society*.

The laboratories which Roscoe designed, and which are known under his name, have long since proved inadequate to accommodate the numbers which now flock to the Manchester School of Chemistry. After Schorlemmer's death it was found necessary to add to their number, and the new Schorlemmer laboratories, of eighty-nine working benches, were built for the special study of organic chemistry. These were in their turn overcrowded, when Mr. Andrew Carnegie, the well-known American multi-millionaire, who never forgets he was born on British soil, presented the University with £10,000 to erect buildings, on condition that they should be called the John Morley Laboratories, in honour of his friend Viscount Morley of Blackburn, the eminent historian and statesman, and now Chancellor of the Victoria University.

On October 4, 1909, Roscoe was requested to open formally the new laboratories, when he remarked: "It was very gratifying to know that Mr. Carnegie, who has spent millions of money on founding public libraries all over the English-speaking countries, seemed to be turning his attention to the foundation of laboratories which, in my opinion, was of still greater consequence." A characteristic remark which those who knew the speaker would be quite prepared to hear.

LIBRARY OF THE BOMBAY BRANCH OF THE ROYAL ASIATIC SOCIETY

CHAPTER VII

ROSCOE AS AN INVESTIGATOR

THE character of Roscoe's scientific work may also be said to have been entirely moulded by his Heidelberg training, and Bunsen's influence may be traced through it to the last. So completely was this the case that consciously or unconsciously he seemed never to contemplate attacking any problem that would not have appealed to, or have been appreciated by, Bunsen.

His first research was undoubtedly suggested by Bunsen. As already stated, it resulted in the classical investigation on the laws regulating photochemical action. It was already known that a mixture of equal volumes of hydrogen and chlorine on exposure to light lost its characteristic colour, and was converted into hydrochloric acid, readily soluble in water; and Bunsen conceived the idea of making this reaction the basis of a method of measuring the relative amount and activity of those light-vibrations which are mainly concerned in effecting chemical change. As a matter of fact the idea was not new, for, unknown to Bunsen, it had already been adopted by Draper, of New York, who had, as he states in his paper in the *Philosophical Magazine* for December 1843:

invented an instrument [based upon the same reaction] for measuring the chemical force of the tithonic rays, which are found at a maximum in the indigo space, and which from that point gradually fade away to each end of the spectrum.

It perhaps says little for the assiduity with which young Roscoe read the original chemical literature of his time that he should only have knowledge of Draper's remarkable papers some thirteen years after they were published in the English journals. But it is only due to him to say the chemical students of University College in those far-off days had fewer opportunities of access to original literature than they now enjoy.

Be this as it may, Roscoe's discomfiture at being thus anticipated was of no long duration.

Do not (wrote Bunsen) let your discovery of Draper's work disconcert you. . . . It appears to me that the value of an investigation is not to be measured by whether something is described in it for the first time, but rather by what means and methods a fact is proved beyond doubt or cavil, and in this respect I think that Draper has left plenty for us to do.

After many fruitless attempts they succeeded in constructing an apparatus in which the defects of Draper's "tithonometer" were obviated, and by which not only accurate comparative determinations could be made, but which enabled them to reduce the chemical action of light to absolute measure. They showed by means of it that the amount of chemical action produced by light from a constant source varied inversely as the square of the distance. They studied more accurately the phenomena of photochemical induction, discovered by Draper, the causes which determine its

occurrence, and the laws which regulate the chemical action of light after the induction is completed. They proved that the absorption of the chemical rays in passing through a medium varies directly as the intensity of the light, and that the amount transmitted varies proportionately with the density of the absorbing medium. It was found that for a given amount of chemical action effected in the mixture of chlorine and hydrogen an equivalent quantity of light is absorbed, and that the coefficients of extinction of pure chlorine for chemical rays from various sources of light are very different. They established a general and absolute standard of comparison for the chemical action of light, and sought to determine the quantitative relations of the chemical action effected by direct and diffused sunlight, and to investigate the laws which regulate the distribution on the earth's surface of the chemical activity emanating from the sun. They also measured the chemical action of the constituent parts of the solar spectrum. The action on the sensitive gas showed the existence of several maxima of chemical intensity in the spectrum. The greatest action was observed between the lines G in the indigo and H in the violet, whilst another maximum was found to be near the line I in the ultra violet. Towards the least refrangible end of the spectrum the action became imperceptible about the line D in the orange, but at the other end of the spectrum the action was found to extend as far as Stokes's line U, or to a distance from the line H greater than the total length of the ordinary visible spectrum.

By investigating the conditions under which it was

possible to prepare a photographic paper of uniform and constant sensitiveness, and ascertaining the means by which the darkening of the paper on insolation could be accurately compared with a standard tint, it was found comparatively easy to construct an instrument capable of measuring the chemical action of light effected at any point on the earth's surface by the total sunlight and diffuse daylight under the most widely varying circumstances of climate and atmospheric condition.

This joint research, begun in 1855, occupied its authors until 1862. Roscoe did the greater part of the experimental work, and after his election to the professorship in Owens College in 1857 he spent his long vacations in Heidelberg in continuing the inquiry. The results were communicated in a series of memoirs to the Royal Society and are published in the *Philosophical Transactions.*[1]

Subsequently he pursued the subject alone or in conjunction with others. In a short paper published

[1] "Photochemical Researches." By R. W. Bunsen and H. E. Roscoe:

Part I. Measurement of the chemical action of light. (*Phil. Trans.* (1857), pp. 355–380.)

Part II. Phenomena of photochemical induction. (*Phil. Trans.* (1857), pp. 381–402.)

Part III. Optical and chemical extinction of the chemical rays. (*Phil. Trans.* (1857), pp. 601–620.)

Part IV. Comparative and absolute measurement of the chemical rays. Chemical action of diffuse daylight. Chemical action of direct sunlight. Photochemical action of the sun compared with that of a terrestrial source of light. Chemical action of the constituent parts of solar light. (*Phil. Trans.* (1859), pp. 879–926.)

Part V. On the direct measurement of the chemical action of sunlight. (*Phil. Trans.* (1863), pp. 139–160.)

in 1863 he gave the results of a series of measurements of the chemical brightness of various portions of the solar disc made by means of standard photographic paper according to the method described by Bunsen and himself in their last communication;[1] and in 1864 he described a method of meteorological registration of the chemical action of total daylight based on a modification of that originally used by Bunsen and himself. The account of this method was made the Bakerian Lecture in 1865, and is published in the *Philosophical Transactions* of that year.[2]

In this paper he gives the results of consecutive observations on each day for nearly a month at about midsummer, and compares the chemical action of light at Manchester at the winter and summer solstices, and the vernal and autumnal equinoxes. The wide variation in the chemical action of light at different periods of the year was illustrated by the fact that if the integral of that on the shortest day be taken as the unit, that upon the equinox will be represented by 7, and that upon the longest day by 25.

In 1866 he and Mr. Baxendell contributed a joint note to the Royal Society on the relative chemical intensities of direct sunlight and diffuse daylight at different altitudes of the sun. They showed from observations made at Manchester and at Heidelberg that the ratio of the chemical intensity of direct to

[1] "On the Measurement of the Chemical Brightness of Various Portions of the Sun's Disk." By H. E. Roscoe. *Roy. Soc. Proc.* XII. (1862), pp. 648–650.

[2] "On a Method of Meteorological Registration of the Chemical Action of Total Daylight." By H. E. Roscoe. *Phil. Trans.* CLV. (1865), pp. 605–632.

diffuse sunlight for a given altitude at different localities is not constant, but varies with the transparency of the atmosphere, and that this ratio does not in the least correspond with the value of visible intensity as estimated by the eye, the action of the atmosphere being 17·4 times greater upon the chemical than on the luminous rays when the sun's altitude is about 25° and 26·4 times greater when it is 12°.[1]

With a view to the introduction of the instrument into meteorology, and as part of the routine work of an observatory, he caused a regular series of measurements to be made during two years at the Kew Observatory, under the direction of Dr. Balfour Stewart; and in order to gain further knowledge of the variation in the chemical action of light in different areas of the earth's surface, he sent the writer in 1866 to Pará, on the river Amazon, 1° 28′ south of the Equator. The selection of this particular place arose from the circumstance that his cousin, now the Right Hon. Charles Booth, was proceeding to the Brazils in connection with the establishment of a new line of steamers, and it was arranged that the writer should accompany him, in order that he might make photometric observations *en route*, going and returning, and at the same time make a series of determinations of the amount of carbon dioxide in sea air, night and day, with a view of testing the truth of an allegation by a French chemist, that it was subject to a diurnal variation, depending upon the intensity of sunlight.

[1] "Note on the Relative Chemical Intensities of Direct Sunlight and Diffuse Daylight at Different Altitudes of the Sun." By H. E. Roscoe and J. Baxendell. *Roy. Soc. Proc.* XV. (1867), pp. 20–24.

The special form of apparatus arranged for making photometric observations at sea proved to be ill-adapted to the purpose. But even if its performance had been good, the conditions under which it had to be employed were incapable of furnishing valid results. Accordingly the writer elected to remain at Pará in order to obtain the required observations at that place, until such time as he could return by the succeeding steamer. He was thus enabled to make a much more extensive set of observations than was originally contemplated, and under conditions which ensured trustworthy measurements.

The following letter, dated May 12, 1866, and received at Pará, refers to these matters. The allusion to Agassiz arose from the circumstance that the great naturalist was at the time engaged in work on the Amazons and its tributaries under the auspices of the Emperor Dom Pedro.

Roscoe himself was busily engaged with his vanadium researches.

Although I was disappointed to find that the *Augustine* returned without you, yet I think that you acted quite rightly in staying until the *Jerome* returns, as you could not get any results whilst on board. I only hope that your health will have been good, and that you will have enjoyed your stay at Pará, and that when you return in August we may have to work out plenty of interesting results.

I send per the *Jerome* a second bottle of silver solution, and some more salted paper, as you may possibly be out of both. I also enclose two or three fixed strips, but *not calibrated*. These, in case you are out, may be used, *carefully preserved* and calibrated, on your return. They must be carefully marked before using and notice taken in the book of the marks on each strip when employed.

. . . . . .

Your carbonic acid observations are *very* interesting: you seem

to have settled Lewy completely, and I hope you will get some more experiments made on your return voyage.

Could you not manage to make several series of *daily* observations (photochemical) on your return voyage? It would not much matter if the surface was not perfectly horizontal always, and you could use your pendulum concern to steady the exposed paper to a certain extent. Perhaps your ship does not give you a sufficiently free horizon. However, you will do what is possible.

Your meeting with Agassiz was very fortunate, and I was glad to hear that the other friends whom you found were likely to prove agreeable.

We have not much news to send you. The book ["Lessons in Elementary Chemistry"] is not yet out. I have this day, however, corrected the last proofs of the Index, and I fully expect that it will be ready (and I hope a great number sold!) before you arrive here.

My new assistant [Mr. Francis Jones] is a very careful and accurate worker. He has with great care determined the atomic weight of vanadium by the loss of weight of VO_3 in hydrogen, and curiously enough gets *exactly* Berzelius's number of 68·5! This in two experiments on large quantities. We are now preparing pure chloride to try again whether we get 67·4 (your number), and we have got hold of some very queer reactions, which I can only understand either by the presence of another metal having the same (or nearly) atomic weight as Va, or else by the existence of an isomeric (solid) modification of the chloride. However, time, I hope, will show.

My lecture on June 1st at the Royal Institution will, of course, be shorn of some of its interest as I cannot tell them how much chemical light there is in the tropics, but I hope to have enough to make an interesting hour, and have got some nice experiments to illustrate the opalescence of the atmosphere.

My wife tells me to remind you to be so good as to bring her something tropical—some birds' skins would do or anything you see or fancy. Only no monkeys, if you please, for me! I hate the animals.

Your father will doubtless send you all the news of the times, as well as local information, and so I will only add that the Laboratory [rowing] crew were again beaten last week. The races were very good—better as regards equality than last year. The umpire, poor R——, got upset and nearly suffocated in the Irwell mud!

Hoping to see you safe back at the end of July or beginning of August.

The day after this letter was written Roscoe received some of the preliminary results of the photometric observations, so that he was enabled to give his Royal Institution audience some idea of the amount of chemical light in the tropics. He made this matter one of the chief features of his lecture.

I have only just time to send what you want over to Liverpool this afternoon, and to acknowledge your letter of April 14th with enclosures, which are all very welcome.

. . . . . .

The diffused and direct sun experiments are very interesting. They differ *in toto* from the Heidelberg results. Pray get some more at low elevations of the sun.

I must now close . . . as the *Jerome* sails early in the morning.

P.S.—I hope you may be able to get *one* cloudless day before you leave, as the clouds evidently much modify the result. It is almost a pity that you did not go out in the vacation for September and October, but it cannot be helped now.

If you get a cloudless day begin early, take four or six sets of observations (one at noon, of course) until late in the evening, so as to get the *low* elevations.

The Kew observations showed that the mean chemical intensity for hours equidistant from noon is practically the same on the same day, and that the daily maximum of chemical intensity corresponds with the maximum of solar altitude. Measurements showing the daily rise and fall of chemical intensity for each of the twenty-four months were obtained, as well as of the biennial variation for the same period. It was pointed out that the curve of yearly chemical intensity is not symmetrical about the vernal and autumnal equinoxes. Thus for 100 chemically active rays falling at the spring equinox at Kew, there fell

at the autumnal equinox 167 rays, the sun's mean altitude being the same, the difference being probably due to the greater atmospheric opalescence in the spring.

The Pará observations were interesting from the fact that they were the first measurements of photometric intensity made within the tropics, and that they served to dispel certain fallacies about photographic effects in very hot climates at that time current. The observations showed that the relation between the sun's altitude and chemical intensity may be represented by the equation:

$$C\,I\,a = C\,I_0 + \text{const. } a,$$

where $C\,I\,a$ represents the chemical intensity at a given altitude a in circular measure, $C\,I_0$ the chemical intensity at the altitude 0, and const. a a number to be calculated from the measurements. Comparisons between the observations at Kew and at Pará on the same days in April showed that the daily mean chemical intensity at the latter place was from ten to fifty times greater than at Kew, the wide differences being due to the enormous and rapid variations in intensity from hour to hour which the chemically active rays experience in the tropics during the rainy season of the year.[1]

The relation between the sun's altitude and the chemical intensity of daylight was more accurately determined by the writer from a long series of obser-

[1] "On the Chemical Intensity of Total Daylight at Kew and Pará, 1865–1867." By H. E. Roscoe. *Phil. Trans.* CLVII. (1867), pp. 555–570.

vations made by Roscoe's method under a cloudless sky near Lisbon in the autumn of 1867. The fact was confirmed that the direct sunlight is robbed of almost all its chemically active rays at altitudes below 10°, and that although the chemical intensity for the same altitude at different places and at different times of the year varies according to the varying transparency of the atmosphere, yet the relation at the same place between altitude and intensity is always represented by a straight line. The differences in the observed actions for equal altitudes, which may amount to more than 100 per cent. at different places, and to nearly as much at the same place at different times of the year, serve as exact measurements of the varying transparency of the atmosphere. As illustrating the wide differences in the daily march of chemical intensity at various places, it was found that, when light of unit intensity acting for 24 hours is taken as 1,000, the value of the mean chemical intensity at Kew is represented by the number 94·5, that at Lisbon by 110, and that at Pará by 313·3.[1]

Roscoe's hope that measurements of the chemical intensity of daylight might become part of the regular work of meteorological observations has, unfortunately, not been realized. Observations of the kind, no doubt, consume much time, and if properly conducted require the whole service of a skilled assistant. But considering the enormously important part played by chemically active light in the economy of nature, and more particularly in the phenomena of

[1] "On the Relation between the Sun's Altitude and the Chemical Intensity of Total Daylight in a Cloudless Sky." By H. E. Roscoe and T. E. Thorpe. *Phil. Trans.* CLX. (1870), pp. 209–316.

vegetable life, it cannot be doubted that a sufficiently long-continued series of observations, systematically carried out on a well-considered plan, at observatories distributed over the earth's surface, would afford most valuable information concerning the facts of solar energy, and incidentally serve to elucidate many important collateral questions. With the assistance of Mr. Horace Darwin, Roscoe made attempts to devise an automatic arrangement which should minimize the labour of observation, but in the absence of any certain assurance that such an instrument would be utilized, the trials were discontinued.[1]

It has been thought desirable, for the sake of continuity, to describe Roscoe's work on chemical photometry, arising out of his association with Bunsen, so long as he continued to pursue that subject. A subsequent paper will, however, be mentioned later.

We must now revert to his work when he returned from Germany.

On leaving Heidelberg to settle again in London, as already stated he engaged Dittmar as research assistant, and they jointly studied, by Bunsen's methods, the absorption of hydrochloric acid and ammonia in water,[2] proving that these gases do not obey Dalton and Henry's law.

He next attacked, first with Dittmar's and then with Schorlemmer's assistance, the nature of the

[1] "On a Self-recording Method of Measuring the Intensity of the Chemical Action of Total Daylight." By H. E. Roscoe. *Roy. Soc. Proc.* XXII. (1874), pp. 158–159.

[2] "On the Absorption of Hydrochloric Acid and Ammonia in Water." *Chem. Soc. Jour.* XII. (1860), pp. 128–151.

aqueous solutions of the common volatile acids of constant boiling-point, and showed that although the ratio of acid to water is constant for a definite boiling-point under a particular pressure, this does not necessarily indicate the existence of definite hydrates. The composition of the hydrated acid on boiling is entirely dependent on the pressure under which it is heated—a strong solution losing acid, and a weak solution losing water until the residue in each case acquires a constant composition, depending upon the pressure under which it is boiled.[1]

In those days Gmelin's "Handbuch" was the chief repository of chemical knowledge—or the want of it—and many suggestions as to possible profitable fields of inquiry were to be gleaned from its pages. One such subject was perchloric acid and its compounds, concerning which but little was then known beyond the composition of potassium perchlorate, established by Stadion as far back as 1816. Roscoe, with Schorlemmer's assistance, made a fairly complete investigation of perchloric acid and its hydrates, and a number of its salts.[2]

He narrowly escaped a serious accident when working with ethyl perchlorate, first prepared in 1840 by the American chemists Hare and Boye, and known to be extremely unstable. He was engaged in filtering a few cubic centimetres of the liquid into a test-tube, when the compound exploded with great

[1] "On the Composition of the Aqueous Acids of Constant Boiling-point." By H. E. Roscoe. *Chem. Soc. Jour.* XIII. (1861), pp. 146–164; XV. (1862), pp. 213–216.

[2] "On Perchloric Acid and its Hydrates." By H. E. Roscoe. *Roy. Soc. Proc.* II. (1861), pp. 493–503.

violence, and a deep hole was bored into the base of the filter-stand, and many hundreds of fragments of glass were driven into his hand. That filter-stand was long an object of interest to visitors in the private laboratory of the old Owens College.[1]

The writer subsequently prepared thallium perchlorate for him in a pure state, determined its composition, and established its isomorphism with the alkaline perchlorates, the crystallographic characters of which had been previously ascertained by Kopp.[2]

But Roscoe's most important contribution to inorganic chemistry was unquestionably his research upon vanadium and its compounds, which occupied him for the greater part of five years. About 1865 his attention was drawn to the occurrence of vanadium in some of the copper-bearing beds of the Lower Keuper Sandstone of the Trias which were then being worked at Alderley Edge and Mottram St. Andrews in Cheshire. He obtained possession of a large quantity of a lime precipitate, which was found to contain about 2 per cent. of vanadic acid. It was a most unpromising material, but eventually a method was worked out by which the vanadium was extracted as an ammonium vanadate: this on heating yielded vanadic acid. Great difficulty was met with in freeing the vanadic acid from accompanying phosphoric acid. Even small quantities of phosphoric acid cause the vanadic acid after fusion to solidify as a

[1] "Note on Perchloric Ether." By H. E. Roscoe. *Chem. Soc. Jour.* XV. (1862), pp. 213–216.

[2] "On the Isomorphism of Thallium Perchlorate with the Potassium and Ammonium Perchlorates." By H. E. Roscoe. *Chem. Soc. Jour.* IV. (1866), pp. 504–505.

pitch-like amorphous mass. It was the writer's privilege to assist in the early stages of this investigation, and it fell to his lot to carry out the various experiments which eventually served to establish the composition of the oxides of vanadium, the true nature of its volatile chloride, the existence of hitherto unknown oxychlorides, and of the mononitride which Berzelius had regarded as the metal, and lastly to fix its real atomic weight and to show that it was approximately 16 below that assumed by Berzelius. It was only very gradually that the true chemical relationships of vanadium revealed themselves. For a time the indications were contradictory and perplexing. The first clue was given by Rammelsberg's observation that vanadinite is isomorphous with pyromorphite and mimetesite—analogously constituted minerals containing phosphorus and arsenic. The next significant fact to be discovered was that by the action of a reducing agent it was possible to obtain a solution of a vanadium oxide which on reoxidation to vanadic acid appeared to require as much oxygen as Berzelius's vanadium, regarded as metal, would have needed. When it was discovered that the volatile chloride which Berzelius had considered was a trichloride and free from oxygen, in reality contained oxygen, and was analogous in constitution to phosphoryl chloride, the whole matter was rapidly cleared up, and the chemical affinities of vanadium to phosphorus, arsenic, and the other members of the trivalent group were established. This, of course, necessitated altering the formulæ of the vanadium compounds hitherto described.

At the close of the College Session 1866–1867,

Roscoe took away with him the laboratory journals containing the results of the inquiry as far as it had progressed, and worked at them at Roddam Hall, near Alnwick, which he had taken for the Long Vacation.

The following letters have reference to this matter:

RODDAM, NEAR ALNWICK,
August 26, 1867.

I write a line to say that I hope you are getting on well and that I shall soon hear from you. . . . I want you very much to stay with me till April to settle the vanadium and light matters and help me in London with my lectures. . . . I have at last found out about vanadium. The acid is V_2O_5 like P_2O_5. The chloride $VOCl_3$ like $POCl_3$ and the solid chlorides $VOCl_2$, VOCl, etc. This explains the isomorphism of the vanadate of lead and the corresponding phosphate and lots of other points. It becomes very interesting now.

Pray write a line and say whether you will stay till April, and when you will be back.

The first paragraph in the next letter alludes to the circumstance that the present writer had just returned from Lisbon, where he had carried out the photometric measurements already referred to.

RODDAM HALL, NEAR ALNWICK,
September 12, 1867.

I was very glad to hear by your note received to-day of your safe arrival and the success of your observations. . . . You did quite right in returning home rather than wait indefinitely for the *Jerome*. The working out of your Pará and of the Lisbon direct and diffuse-light experiments will take some time and labour, but I believe the results will repay the trouble. . . .

I have been up to the Dundee [British Association] meeting for a few days, but I now, in all probability, shall stop here, so that I can at once answer your letter.

The Right Hon. Sir Henry E. Roscoe

Please ask Joseph [Heywood] to send me per book-post *Pogg. Ann.*, vol. 98, in which volume is Rammelsberg's paper on the isomorphism of vanadates and phosphates. There is no doubt in my mind that vanadic acid is V_2O_5, and it will be *exceedingly* interesting to work out the vanadates which must all be explained as phosphates. The ordinary white NH_3 salt is NH_4VO_3 (like $NaPO_3$) and is a meta-vanadate. The bi-vanadates can also be explained, but all need re-preparation and analysis. Did I tell you that we have now got

V_2O_5, V_2O_4, V_2O_3, V_2O_2 (I wish we had V also !)

$V_2O_2Cl_6$, $V_2O_2Cl_4$, $V_2O_2Cl_2$, and $V_2O_2Cl_6$, or $VOCl_3$, $VOCl_2$, $VOCl$

At St. Andrews I saw Professor Heddle; he has a crystal half apatite and half vanadinite, and he threw out the suggestion long ago that vanadic acid is V_2O_5. . . . I hope you will write soon and let me hear what you have to say about my plan. I will then write what I think of your ideas.

RODDAM,

Tuesday, September 17, 1867.

I have now edited the atomic weight determinations by oxidation, and also the various oxides of vanadium. I have now to do the chlorides. Many points still remain requiring clearing up.

(1) As regards the slow oxidation of the V_2O_3 (Berzelius's suboxide); a sample made on November 13, 1866, weighing 0·7507, weighed on June 12, 1867, 0·8733. This corresponds to an oxide higher than V_2O_4 (V=51·4). Now I want this oxide and tube drying under the air-pump and weighing carefully and keeping for further examination (the weight of tube and oxide was 3·6066 on June 12th last).

(2) When a neutral solution of V_2O_2 in SO_4H_2, got by zinc reduction, and neutralized by excess of zinc, is exposed to a current of air, it goes brown, and this brown colour does not alter. Analysed by permanganate it would seem to contain V_2O_4. I want this confirming.

(3) Try to get sight of a copy of Greg and Lettsom's "British Mineralogy" (you can go and call on Mr. Robt. P. Greg, Greg Bros., Chancery Lane, and ask him to lend you the book for me). Under "Vanadinite" you will see some

mention of Heddle and his observations. I find nothing about him in Rammelsberg's paper.

(4) Has V_2O_4 been prepared by heating the suboxide V_2O_3 in the air at low temperatures? Is it green?

The thing above all others necessary for us now is to get the *metal.* We must set about this at the beginning of the session.

If you have time before you go away to clear up these four preliminary points I shall be glad.

RODDAM,
September 26, 1867.

The first thing to do when we begin will be to try to get the metal $V = 51{\cdot}3$ by forming the ammonio-chloride and reducing the nitride in ammonia. . . . If we only can get 0·5 of metal the question of atomic weight is settled beyond dispute.

I have now collated all the experiments: (1) On the oxides of vanadium; (2) on the determination of atomic weight by reduction of V_2O_5 to V_2O_3; (3) on the oxychlorides and determination of atomic weight from the chlorine determinations. These latter require re-calculation as I do not know how much should be allowed for as impurity in the silver. Still, I see already that this alteration can be but very slight, and the numbers agree very well, viz. (1) mean at. wt. from reduction expts. 51·362 (probable error 0·068); (2) mean of 9 volumetric chlorine determinations of the oxytrichloride 61·28; (3) mean of 8 weight determinations of chlorine 61·21, so that as far as I yet see the true atomic weight is 51·30.

I am obliged by your extract from Greg and Lettsom. When in St. Andrews I saw Professor Heddle, and he promised to send me some crystallized specimens of vanadinite and pyromorphite existing in one crystal.

I think I have got quite matter enough for one paper, but I should like to have the metal if only in sufficient quantity to oxidize up to V_2O_5 and determine the increase. Everything can be very nicely used, and all fits in well; but, of course, such a first paper must in some points be imperfect.

I think it is perhaps best that —— should give the lectures, as I am sure to want you in London several Saturdays—otherwise I should have been very glad for you to have taken the course.

You will be back on Saturday, October 5th, I suppose. We must re-calculate all the analyses with the exact atomic weight. This can

soon be done, and I should like to get this first part off my hands before long.

I hope you are enjoying this splendid autumn weather.

. . . . . .

As regards the blue oxide got by gradual oxidation of V_2O_3 (sub-oxide) we have analyses proving it to be V_2O_4—by oxidation. It is very possible that the further increase in weight is due to the hydration of this oxide. We must wait until the green substance remains constant, and we must then determine the water and the V_2O_5.

Roscoe's first memoir on the subject was read to the Royal Society on December 19, 1867, and was made the Bakerian Lecture of that session.[1] On February 14, 1868, he gave a Friday evening discourse at the Royal Institution "On Vanadium, one of the Trivalent Groups of Elements," when the writer acted as his lecture-assistant. Having arranged the experimental illustrations, the assistant spent a spare half-hour in wandering through the old laboratories in the cellars of the Institution, sacred to the genius and labours of Davy and Faraday. In looking over some specimens in a cupboard he came upon a small bottle containing ammonium vanadate, labelled "Sent to me by Berzelius. 1831," and on it Faraday's well-known monogram by way of signature. A portion of the substance was afterwards placed at Roscoe's disposal by the late Sir Edward Frankland, at the time Fullerian Professor of Chemistry. On examination it was found to contain considerable quantities of phosphoric acid, thus serving to indicate the probable cause of the discrepancy between the numbers obtained by Berzelius and Roscoe in the course of the atomic weight determinations. It had been observed that

[1] "Researches on Vanadium." Part I. By H. E. Roscoe. *Phil. Trans.* CLVIII. (1868), pp. 1–28.

the presence of even traces of phosphorus prevents the complete reduction in hydrogen of the vanadium pentoxide to vanadous oxide.

Some little time after the appearance of the first memoir on vanadium, the writer proceeded to Heidelberg to study under Bunsen, to whom at that time practically all Roscoe's senior students who were in a position to go to Germany were sent. It had been reported in a French periodical on popular science that Roscoe had been awarded the Copley medal for his work on vanadium, and of course his former assistant had hastened to congratulate him on that event.

CAMFIELD PLACE, HATFIELD, HERTS,
September 13, 1868.

In the first place let me thank you for your letter and congratulations upon the great French discovery! Many of these Parisian wonders have after all turned out myths—and this last is, I believe, no exception—the expression "Medaille de Copley" is, so far as I am aware, the French (and bad French too!) for the "Bakerian Lecture." I am, however, none the less obliged to you for your good wishes on this occasion, and for all the valuable help which in many ways you gave me.

. . . . . .

Thanks for your news of my dear friend. I have been very remiss in not writing to him. Tell him so, please; and ask him to send me the first proof-sheets of his "Filtration" paper for me to translate; unless, indeed, you do it yourself, as I am sure you can perfectly well. Give B[unsen] my kindest regards, and say that I will write to him soon.

Part II of "Researches on Vanadium," dealing with the chlorides VCl_4, VCl_3, and VCl_2, and metallic vanadium, which he obtained by heating the dichloride in hydrogen, was presented to the Royal

Society on June 16, 1869,[1] and his last memoir, treating of the bromides, and of certain of the metallic vanadates, including vanadinite which he prepared artificially, on April 7, 1870.[2]

With the mention of a short communication, "On Two New Vanadium Minerals," to the *Proceedings of the Royal Society* for 1876,[3] and of a lecture on "Recent Discoveries about Vanadium" at the Royal Institution, the foregoing statement includes all Roscoe's published contributions to the history of vanadium. As regards original work, he handed over the subject to his senior students, and under his inspiration and direction a considerable number of communications from the Owens College Laboratory were made to the Chemical Society from Crow (1876), Bedson (1876), H. Baker (1878), Kay (1880), Brierley (1886), Hall (1887), and published in the *Transactions of the Chemical Society*.

Other noteworthy contributions by Roscoe to inorganic chemistry are his study of tungsten compounds, in which he describes for the first time the existence of the pentachloride WCl_5 and the corresponding pentabromide WBr_5,[4] and his discovery of uranium pentachloride, UCl_5.[5]

[1] "Researches on Vanadium." Part II. By H. E. Roscoe. *Phil. Trans.* CLIX. (1869), pp. 679–692.

[2] "Researches on Vanadium." Part III. By H. E. Roscoe. *Phil. Trans.* CLX. (1870), pp. 317–332.

[3] "On Two New Vanadium Minerals." By H. E. Roscoe. *Roy. Soc. Proc.* XXV. (1877), pp. 109–112.

[4] "A Study of Certain Tungsten Compounds." By H. E. Roscoe. *Manchester Lit. Phil. Soc. Proc.* XI. (1872), pp. 79–90.

[5] "On a New Chloride of Uranium." By H. E. Roscoe. *Chem. Soc. Jour.* XII. (1874), pp. 933–935.

These compounds are of considerable theoretical interest on account of their "anomalous" character. He also discovered columbium trichloride, $CbCl_3$, which he found to have the remarkable property of decomposing carbon dioxide when heated in that gas with the formation of columbium oxychloride, $CbOCl_3$, and carbon monoxide — a reaction not exhibited by any other metallic chloride (*Chem. Soc. Abstracts*, 1878, 272), and he determined the vapour densities of the chlorides of lead and thallium which he showed to be normal.[1]

An examination of the earth metals contained in samarskite proved that the rare earth-metal announced by Delafontaine under the name of "philippium" was a mixture of yttrium and terbium.[2]

The spark spectrum of terbium was at the same time mapped by him and Schuster. An examination of a specimen of oxide which ought to contain "philippium" in large quantities if that chemical element existed showed no conclusive evidence of any other metals than yttrium or terbium.[3]

In 1882 he sent to the French Academy a note on a re-determination of the atomic weight of carbon by the method of Dumas and Stas, using Cape diamonds, and obtained the value 12·002 (O = 16) as the mean of six experiments (*Chem. Soc. Abstracts*,

[1] "Note on the Specific Gravity of the Vapours of the Chlorides of Thallium and Lead." By H. E. Roscoe. *Roy. Soc. Proc.* XXVII. (1878), pp. 426–428.

[2] "A Study of Some of the Earth-metals contained in Samarskite." By H. E. Roscoe. *Chem. Soc. Jour.* XLI. (1882), pp. 277–282.

[3] "The Spectrum of Terbium." By H. E. Roscoe and A. Schuster. *Chem. Soc. Jour.* XLI. (1882), pp. 283–287.

1882, 724). He also showed, with the assistance of Schuster, that the spectrum of the carbon dioxide furnished by the South African diamond was identical with that furnished by other forms of carbon.

So long as he remained in Manchester Roscoe was in the habit of making occasional contributions to the meetings of the Literary and Philosophical Society on general or local interest. Among these communications were papers on arsenic-eating in Styria; on a crystallizable carbon compound in the Alais meteorite; on the amount of carbonic acid in Manchester air; on the corrosion of leaden hot-water cisterns; Dalton's first table of Atomic Weights, etc. — all of which are printed in the *Proceedings* or *Memoirs* of the Society.

Roscoe was largely instrumental in making spectrum analysis first known to British men of science and the British public generally. Almost immediately after the publication of Bunsen and Kirchhoff's classical paper in *Poggendorff's Annalen*, he translated it for the *Philosophical Magazine*. He also gave many public lectures on the subject, beginning with that at the Royal Institution on March 1, 1861—one of the most successful of the many he delivered there. Indeed, there were few of our larger towns in which he was not invited at one time or other during the sixties and early seventies to lecture on that astonishing development of nineteenth-century science. These lectures involved no inconsiderable effort. They necessitated much bulky and fragile apparatus difficult to transport. Some of the illustrations could only be shown to a large audience by means of the electric lantern,

and this, in those days, needed the provision of a large battery of Groves's cells; electricity "laid-on" by a public authority was not then, as now, almost everywhere available.

One of these courses of six lectures given to the Society of Apothecaries of London in 1868 was subsequently published, with additions, in an admirably illustrated volume which had a considerable measure of success—a second edition, still more largely augmented owing to the extraordinary rapidity with which knowledge on celestial chemistry increased, being called for within a year. In the preparation of a third and fourth edition he was assisted by his friend Dr. Schuster. As the successive editions show, the rate at which literature accumulated round the subject was altogether unprecedented in the history of scientific discovery.

Roscoe made an attempt to apply the spectroscope to the Bessemer process of steel manufacture, and for this purpose caused a long series of observations to be made, first at Brown's Atlas works in Sheffield, and then at the Crewe works of the L. & N.W. Railway Company, when a considerable amount of information concerning the peculiarities of the spectrum of the converter-flame was gained, mainly by the observations of Dr. W. Marshall Watts, a former student and one of his assistants, who took over the subsequent conduct of the inquiry.

Considering his interest in the subject, comparatively little original work on spectroscopy was published by Roscoe.

The following is a list of the inquiries with which he was concerned:

"On the Effect of Increased Temperature upon the Nature of the Light Emitted by the Vapour of Certain Metals on Metallic Compounds." By H. E. Roscoe and R. B. Clifton. *Manchester Phil. Soc. Proc.* II. (1860–1862), pp. 227–230.

"Note on the Absorption-spectra of Potassium and Sodium at Low Temperatures." By H. E. Roscoe and A. Schuster. *Roy. Soc. Proc.* XXII. (1874), pp. 362–364.

"On the Absorption-spectra of Bromine and Iodine Monochloride." By H. E. Roscoe and T. E. Thorpe. *Phil. Trans.* CLXVII. (1878), pp. 207–212.

"Note on the Identity of the Spectra Obtained from the Different Allotropic Forms of Carbon." By H. E. Roscoe and A. Schuster. *Manchester Lit. Phil. Soc. Proc.* XIX. (1880), pp. 46–49.

"The Spectrum of Terbium." By H. E. Roscoe and A. Schuster. *Chem. Soc. Jour.* XLI. (1882), pp. 283–287.

The only attempt he was able to make to contribute to our knowledge of the chemistry of the sun by spectroscopic observations had an unlucky ending. He formed one of the members of the Government expedition sent to Sicily to observe the total solar eclipse of December 22, 1870. The following letters refer to this subject:

VICTORIA PARK, MANCHESTER,
November 2, 1870.

Lockyer has asked me to go with him in the American Eclipse Expedition. I have a good mind to do so, but I have written to say that I was not sure that I could make the observations alone (!), and that it would be very desirable that you should go too! So we shall see what comes of it.

I am unfortunately laid up with an attack of gout, which quite disables me and reduces me to the level of the beasts that perish. However, I hope soon to be all right again.

I will write to Francis about the Lisbon paper, which ought certainly to be out. . . .

Did Schorlemmer write to you about your attacking the Germans for attacking the French? He was quite wild, and came up to me in such a state of excitement that I could scarcely understand what

he said. However, under the influence of cigars and a bottle of sherry he cooled down again and perhaps has buried his resentment.

Huxley comes for the first of the Science Lectures on Friday.

I am delighted to hear of your numbers of evening students, and was much pleased by your Introductory. I have no doubt that the laboratory will fill too. You must have patience.

OWENS COLLEGE, MANCHESTER,
November 19, 1870.

Of course you come to Sicily. . . . Lockyer thinks of going on December 8th. Perhaps I may go a day earlier—with you if you can come—and spend twenty-four hours in Heidelberg.

I send box, stand, papers, and all I can find—except insolation affairs which cannot yet be got out of H——'s hands. He shall have no peace till they are ready, and they shall then be sent at once to you. *You* will be responsible for the whole apparatus being in order. Look them over carefully. . . . You know what is wanted.

Unfortunately H.M.S. *Psyche*, the vessel conveying the party from Naples, was wrecked off Aci Reale, about a couple of miles to the north of the classic Cyclops rocks, and under the shadow of Etna, by striking a submerged and uncharted rock. The ship was badly holed, and rapidly began to fill, but fortunately the weather was fine and the sea calm, and all were got safely on shore. The cliffs were scarcely 200 yards away, but the landing was difficult, the jagged reefs of lava seeming to afford no sure footing. Eventually all the instrumental equipment was also landed, in a more or less damaged condition, but much of the personal baggage was lost. A letter written by one of the members of the expedition which found its way into a Manchester newspaper thus describes the event:

We formed ourselves into a line to pass the things along the rocks to the prominence which we had mounted. . . . Everybody worked

with a will, and laboured like galley-slaves. The ship had now settled down considerably; the water was up to her quarter, and the boats pushed off in the expectation that she would roll off the reef. By this time we had almost stripped the ship of everything easily movable, and we prepared to get it to a secure place. The nearest point habitable was Catania, seven miles to the south, and we got the boats ready to take ourselves and our things thither. . . . Roscoe assumed command of our expedition. Everybody seemed to look to him instinctively. I shall never forget the sight of him, standing, with his legs apart to steady himself on a narrow piece of the lava rock, with his arm stretched out, giving his orders with the authority of one who seemed born to command. As the gig was about to push off I saw him look round, and when he saw me he motioned for me to get into it. . . . In a few hours the remainder of the party arrived, and shortly afterwards the luggage and apparatus.

It was arranged that Roscoe, assisted by the late Sir George Darwin and Mr. Bowen of Harrow School, should make observations on the spectrum of the corona from a position on Mount Etna as high as the snow would permit. On the day before that of the eclipse the party had toiled up more than 5,000 feet of the mountain with their instruments strapped on the backs of half a dozen mules, to a deserted hut on the side of the volcano. The night was spent in a storm of rain and snow, and next morning, in a piercing wind, the instruments were put together with benumbed fingers. As the sun was gradually covered, the sky became clouded over and the upper part of Etna was completely enveloped in fog, and during the minute of totality a violent hailstorm broke over the party, rendering all observations impossible.

A number of measurements of the chemical intensity of daylight during the progress of the eclipse

were, however, made by the writer at Catania, some little distance away, by the method described by Roscoe in the Bakerian Lecture for 1865. These showed that the diminution in the total chemical intensity of the sun's light during an eclipse is directly proportional to the magnitude of the obscuration of the solar disc.[1]

This matter is referred to in the following letter.

June 11, 1871.

The results are very interesting, and you have worked them out in an *admirable* manner. I had no idea that so much could be made out.

I am writing at once to Airy and Lockyer to ask them whether we may not send the paper to the Royal Society (last meeting on *Thursday next*) so as to have it in series with our other papers.

I have just heard from Wild, the director of all the Russian observatories, that he is anxious to adopt the plan over all the Russias, and wants an automatic arrangement. So I am going in for it and hope to get a machine made before long. It is really too important to be delayed.

You deserve great credit for your labours, and by rights the paper should be *yours alone*, but perhaps we [had] better keep together. We can do the automatic affair also together if you like.

The automatic arrangement alluded to has already been mentioned. It was not proceeded with.

[1] "On the Measurement of the Chemical Intensity of Total Daylight made at Catania during the Solar Eclipse of December 22, 1870." By H. E. Roscoe and T. E. Thorpe. *Phil. Trans.* CLXI. (1871), pp. 467–476.

LIBRARY OF THE BOMBAY BRANCH OF THE ROYAL ASIATIC SOCIETY

CHAPTER VIII

ROSCOE AND CHEMICAL LITERATURE

Roscoe's services to chemistry are to be measured as much by his contributions to its educational literature as by his efforts to enlarge its boundaries by original inquiry. For there can be no question that his various text-books, ranging from the most elementary "first-steps" and primers, through different grades to the most comprehensive of treatises, have proved of the greatest service to the teacher, and have exercised a profound influence in the diffusion of chemical knowledge in this country and abroad.

His "Lessons in Elementary Chemistry," one of the earliest of Macmillan's series of class text-books, was first published in 1866, the fair copy for the press being written out with characteristic neatness by his wife. Its appearance so soon after the remarkable report of the Duke of Devonshire's Commission which had awakened widespread attention to the almost universal neglect of all science teaching in our public schools was most timely. The book went through edition after edition, and despite the competition of dozens of similar works is still a favourite class-book.

At the suggestion of his friend Lothar Meyer it was translated into German by Schorlemmer, and

published by Vieweg & Son, and has been largely used in German schools and colleges. Translations have also appeared in Russian, Italian, Hungarian, Polish, Swedish, in modern Greek, Japanese, and in one of the Indian vernaculars, Urdu. Concerning this last translation, Roscoe used to tell an amusing story. The Urdu work was lithographed, not printed, the page being nearly twice the size of that of the English original, which was a small octavo. The illustrations were also proportionately magnified, including that showing the length of a decimetre and its sub-divisions of centimetres and millimetres!

Still more successful, as regards its sale, was his "Chemistry Primer," published in 1870, and intended to serve as the first step in chemistry in schools. It also was widely translated, editions having appeared in Icelandic, Polish, German, Italian, Japanese, Bengali, Turkish, Malayalam, and Tamil.

He also published two text-books on "Inorganic Chemistry," one for beginners, in conjunction with Dr. Lunt; and a larger one for advanced students, in association with Dr. Harden, each of which has reached a second edition.

A far more ambitious undertaking was the preparation and publication of the large "Treatise on Chemistry," in the writing of which he had the invaluable co-operation of his colleague Schorlemmer. The first volume appeared in 1877. It is so well known that no description of it is necessary. It is an eminently readable work, admirably printed and beautifully illustrated. Indeed, in style and appearance it is hardly approached by anything of the kind in the language. It was translated into German by

Schorlemmer, and published by Vieweg & Son, and has now largely replaced the time-honoured Graham-Otto as a text-book in German colleges and technical schools. Unfortunately, owing to Schorlemmer's death in 1892, the organic section in the English edition was never finished. It has, however, been completed in the German edition under the direction of the late Professor Brühl of Heidelberg—a circumstance which would seem to throw some light on the comparative position of organic chemistry in this country and in Germany. It ought, however, to be stated that if the whole of the organic section were compiled with the same attention to historical detail, and the same fullness of information that characterizes the inorganic portion, the work would become practically unsaleable on account of its size. At the time the treatise was planned the extraordinary expansion of organic chemistry which has occurred during the past forty years could hardly have been anticipated. It may be, as old Thomas Fuller wrote, that "learning hath gained most by those books by which the printers have lost." But philanthropy is not the first business of publishers.

The inorganic section of the English work has passed through several editions, and was thoroughly revised and largely re-written from time to time with the help of numerous collaborators. The fifth edition on "The Metals and their Compounds" made its appearance in the autumn of 1913—and is a goodly volume of nearly 1,500 pages. Roscoe, then in his eightieth year, worked hard at the revision and read the proofs with all the care and diligence he expended on the original work.

Some time prior to 1895 he was induced by his friend, the late Sir Wemyss Reid, to undertake the editorship of the Century Series of Biographies of Scientific Men, projected by Cassell & Co. To this he contributed a popular account of the life and work of Dalton under the title of "John Dalton and the Rise of Modern Chemistry"—a little work which he wrote with much zest and a thorough appreciation of the fine character of the grand old Cumbrian Quaker.

Mention has already been made of the "New View of Dalton's Atomic Theory," which Roscoe published in collaboration with Dr. Harden. This book is of considerable interest and value in regard to the genesis of a conception which marks a turning-point in the history of chemistry. From a careful study of Dalton's manuscripts and note-books which had been discovered in the rooms of the Literary and Philosophical Society of Manchester, the authors were led to conclusions concerning the origin of the atomic theory of chemistry which differ fundamentally from those which had been generally accepted. It had hitherto been supposed that it was the experimental discovery of the law of combination in multiple proportions which, in his search for an explanation of this fact, led Dalton to the idea that chemical combination consists in the approximation of atoms of definite and characteristic weight, the theory of atoms being adopted to explain the facts discovered by chemical analysis. In reality the exact opposite was the case. It was the theory of the existence of atoms of different weights that led Dalton to the discovery of the facts of combination in multiple proportions.

The late Dr. Debus, some two years previously in a pamphlet published at Cassel, had reached a similar conclusion from a study of Dalton's published works, but by a different line of argument. As a matter of priority there is no doubt that to Debus belongs the credit of first pointing out that the commonly accepted view of the genesis of Dalton's atomic theory is erroneous, but it is no less true that the method of reasoning by which he came to that conclusion cannot be substantiated even if it is not actually disproved by the evidence from Dalton's note-books. Of course the idea of atoms, that is, of small indivisible particles, did not, as is popularly supposed, originate with Dalton: it is older than Science itself. How and where it first arose cannot be exactly stated. Dr. Debus attributes it to Moschus, a Phœnician philosopher living at Sidon about 1100 B.C. It was resuscitated by Gassendi in the middle of the seventeenth century, and applied by Boyle, who speaks of it as the Phœnician philosophy, to the explanation of chemical phenomena. Newton made use of it to explain Boyle's law and the "spring of air." Dalton almost certainly derived it from Newton, with whose corpuscular notions he was quite familiar, and employed it to explain the phenomena of diffusion and absorption. He was therefore quite ready to extend it to all gaseous phenomena, and indeed to chemical phenomena in general, to the extent that it seemed applicable.

It has been held that Dalton anticipated Avogadro in assuming that all gases contain equal numbers of "atoms" (molecules). Dr. Debus adopts this view, and assumes that Dalton in 1801 made use

of it to explain the phenomena of the diffusion of gases, and that this idea, along with his early experiments on nitric oxide and oxygen, led to his atomic theory. Roscoe and Harden, on the other hand, held that Dalton never definitely held the view that equal volumes of gases contain an equal number of atoms (molecules), nor had such a conception any bearing upon his explanation of the facts of diffusion. Dissatisfied with the theory which he did hold (viz. the repulsion exerted by an atom on all others of its kind, but not on atoms of a different kind), he was led to consider the behaviour of atoms of unequal size, and finding an agreement with the observed facts, he then sought for means of determining whether or not the atoms were actually of unequal size, and so was led to the further developments of the theory. The weight of the evidence goes to show that Dalton arrived at his theory in the latter half of 1803, and that the assumption on which it turned was "that no two species [of pure elastic fluids] agree in the size of their particles." There is no clear indication that Dalton ever imagined that the simple gases were diatomic in structure, which, of course, is the main point in Avogadro's hypothesis. It seems necessary to set out this matter in some detail as misapprehension appears to exist, especially in Germany, as to the merits of the controversy which arose after the appearance of Roscoe and Harden's work.

Some years after he had reached the allotted span, Roscoe was induced to think of putting his reminiscences on paper. It was at no time easy to get

him to talk about himself, and the effort of recalling his recollections with a view to printing them was irksome to him. The autobiography consequently made no very rapid progress; it ultimately got into something like a tangle, and was more than once on the point of being committed to the flames. However, during a particularly stormy winter at the seaside, when he was confined to the house, a sustained effort on the part of a determined coadjutor got it into shape, and under the title of "The Life and Experiences of Sir Henry Enfield Roscoe, D.C.L., LL.D., F.R.S. Written by Himself," it was published by Macmillans in the spring of 1906. The book was well received. It was recognized as possessing at least two of the main essentials of a successful autobiography—something worth writing about and the faculty of narration. It is written with sincerity and directness, and with, as one critic said, "a charming simplicity of style and thought, illumined throughout by a soft glow of kindly humour" eminently characteristic of its author, and is of interest as a record of a singularly full and varied career. The gospel of work never had a more strenuous disciple. It has historical value also as the story of the educational changes, particularly in science, which he helped to secure or lived to witness. It reflects many of his noteworthy features: his strong common sense; his straightforwardness and honesty of purpose; his liberality and invincible optimism: his geniality and sense of humour. His enjoyment of a good story makes him tell it even if he is the victim of it. The whole is a pleasing picture of a uniformly calm, contented, and suc-

cessful life — of the life of one who was what the Romans called "a man of good fortune," that is, of one whose prosperity was not the result of chance or accident, but of wisdom and the capacity to bring its aims and efforts to a successful ending.

CHAPTER IX

ROSCOE AND THE ORGANIZATION OF SCIENTIFIC SOCIETIES

Roscoe was elected into the Royal Society in 1863, and served on its Council from 1872 to 1877, and again during two subsequent periods, viz. 1881–1883 and 1888–1890. He was a Vice-President in 1881–1882, and again in 1888–1890. He gave two Bakerian Lectures, viz. in 1865 and 1868, and was awarded a Royal Medal in 1873 "for his various Chemical Researches, more especially for his Investigations of the Chemical Action of Light, and of the Combinations of Vanadium."

He joined the Chemical Society in 1855, and was a member of its Council in 1860–1864, and again in 1871–1873. He was a Vice-President in 1873–1875, and again in 1877–1880, and was President from 1880 to 1882. His two presidential addresses, "abstracts and brief chronicles of the time," dealt mainly with the results of chemical inquiry during the preceding year, especially in relation to the inorganic section of the science. On the first occasion it fell to his duty to refer to the death of Sir Benjamin C. Brodie, a former secretary and president of the Society, whose friendship, as his autobiography

testifies, he valued "as that of a true, generous, and noble-hearted man."

Roscoe was the Mæcenas of the Chemical Society. Indeed, he may be said to have resembled that grand seigneur in the simplicity and cordiality which, as the poet tells us, characterized his relations to the men of his circle. Certainly no Fellow of the Society ever showed himself a more beneficent or more generous patron. The walls of its rooms bear witness to his kindly thought and constant remembrance. Its library has been augmented by gifts from him of close upon a thousand volumes, including rare alchemical and early chemical works, and of complete sets of some of the most valuable of the serial publications of the science.

It was in grateful recognition of this liberal and warm-hearted encouragement of the objects for which the Society was instituted that his old pupils resolved to commemorate his connection with it by placing, on the occasion of his eightieth birthday, his bust in the library which he had done so much to enrich, and at the same time to offer a replica of Mr. Drury's admirable work to his family.

Roscoe was one of the original members of the Society of Chemical Industry, and took a leading part in establishing it on its present basis as a national institution, with local sections in many of our principal towns, and branches in certain of our colonies, and in America. How it originated may be gleaned from the following letter. There had been a previous attempt to establish a local society with special reference to the South Lancashire district. But Roscoe, with others of its projectors,

had conceived the idea of placing it on a wider plane, and the meeting referred to was called to ascertain the general feeling as to the expediency of the action.

THE OWENS COLLEGE, MANCHESTER,
April 13, '80.

We are going to have a meeting *here* on Monday next, at 7 p.m., of chemical manufacturers and others, to consider the question of the establishment of a Lancashire Chemical Society, or of a more General Institute or Society of Chemical Engineers.

If you can come over I should be very glad, as it is likely to be an important meeting and your opinion would be of value.

I congratulate you (and Mrs. Thorpe) on your completion of the paper. We are to decide, or begin to decide, about the Chemical Society Medal on Thursday, and I hope it will be settled to your satisfaction.

At this gathering it was decided to attempt to establish a society to subserve the general interests of chemical industry and not merely those of the South Lancashire district, and to call a meeting in London to discuss the project. He presided at this meeting in the rooms of the Chemical Society when the Society was formally inaugurated. He served as its first President, and was the first chairman of its Manchester section. He opened the proceedings of its first annual general meeting in 1881 with an account of the reasons for the formation of such a society; he indicated its proposed scope, and dwelt upon the many advantages to science and industry that might be expected to follow its creation. What he said then is not less pertinent now. Perhaps, indeed, it is even more so. His words were words of wisdom and of warning. Read in the fierce light of current

events, and of present disabilities, we may well inquire whether the generation that has passed has been as mindful as he had hoped it would be of its opportunities. If it had quickened its energies and marshalled its forces as he encouraged it to do, we should have been better able to meet the strenuous times that are now in store for us. For upwards of a century—ever since, indeed, the renascence of chemical science which originated with Lavoisier—far-sighted men have been preaching the same story. But to the great majority in this country it has been as seed fallen by the wayside. Not so abroad. Thanks mainly to a clearer recognition of the part that science plays under the changing and progressive conditions of modern life, other nations have been more heedful: the seed with them fell upon more receptive soil. The catastrophe which has overtaken us has brought a rude awakening. We are beginning to realize the imperfection of a system of national education which has no adequate relation to present-day necessities.

Roscoe, one is consoled to think, lived to see the evidence of this quickening. The doctrine which he preached with an insistency and pertinacity that never flagged, during more than half a century, is now, under the stress of necessity, coming home to men's business and bosoms as it never did before.

One proof of the Society's recognition of its indebtedness to its first President may be seen in the award to him of its medal on the occasion of the Nottingham meeting in 1914.

In 1909 he was Honorary President of the Seventh International Congress of Applied Chemistry

which met in London in that year. It was his wish that his friend, Dr. Ludwig Mond, as an eminent industrial chemist, should be appointed to that office, but Mond declined the position and proposed Roscoe's name instead at the preceding meeting in Rome.

To Roscoe, therefore, fell the honour of introducing the Prince and Princess of Wales—our present King and Queen—to the meeting of three thousand industrial chemists assembled in the Albert Hall, when the Prince welcomed the gathering in a felicitous speech. The foreign delegates were afterwards received in private audience by King Edward VII, when Roscoe, as Honorary President, had the honour of presenting them.

Roscoe's first introduction to the British Association was at the Glasgow meeting in 1855, when the late Lord Playfair was President of the Chemical Section, and when he himself acted as the secretary. At this meeting he read a paper on the results of a joint investigation with Bunsen on the action of light upon chlorine water, an examination and extension of Wittwer's work on the same subject. This was subsequently published in the *Journal of the Chemical Society* and in *Liebig's Annalen.* As already stated, he acted as one of the local secretaries at the Manchester meeting of 1861, when he presented a report jointly with the late Drs. Schunck and R. Angus Smith, "On the Condition of Manufacturing Chemistry in the South Lancashire District" (*Brit. Assoc. Rep.* 1861, pp. 108–128). At the Bath meeting in 1864 he gave one of the evening lectures on the chemical action of light. At the Liverpool

meeting of 1870 he presided over the Chemistry Section.

Then, as now, France and Germany were at war, and that fact naturally called for reference. But, *Eheu!* neither the cosmopolitan character of Science to which he then alluded, nor upwards of forty years of that comity among those interested in Science and its applications which he confidently hoped would "render impossible the breaking out of disasters so fatal to the progress of Science and to the welfare of humanity!" as he then witnessed, have served to avert an even more fearful disaster. The small but living fire which he contended would in the end surely serve to melt down national animosities has been now almost wholly extinguished by the arrogant pride and lust of power which has obsessed a nation claiming to be the most enlightened in the world.

In 1884 he again served as President of the Chemical Section at the meeting in Montreal. In 1887 he was President of the Association at the Manchester meeting in that year—an honour he prized all the more on account of his long association with that city. The meeting was notable as being the largest held since the foundation of the Association, and was specially characterized by the number of foreign chemists who were present. He continued to take an active interest in the affairs of the Association up to the time of his death, and was a constant attendant at the meetings of its Council.

CHAPTER X

PUBLIC SERVICES—POLITICAL AND PROFESSIONAL WORK

ROSCOE'S position in the educational world, and in scientific circles, coupled with his well-known business capacity and sound judgment, frequently led to his being invited to place his knowledge and experience at the service of the State in connection with Royal Commissions and Departmental Committees. During his tenure of his professorship at Manchester he served on two important Royal Commissions; the first in 1876, when Mr. Cross, then Home Secretary, nominated him as a member of Lord Aberdare's Commission on Noxious Vapours, which led to the amended Alkali Acts of 1891 and 1892; the second in 1881, when Mr. A. J. Mundella, then Vice-President of the Education Council, appointed him a member of Sir Bernhard Samuelson's Commission on Technical Instruction—one of the most important Commissions ever issued by reason of its influence on the industrial history of this country. Roscoe threw himself heart and soul into its work. The task was thoroughly congenial to him, for he was profoundly convinced of its importance. It required long and frequent visits abroad in order to inquire into the methods of the continental trade-schools and polytechnics, and to

judge by direct observation of their results. The preparation of the Report was a tedious and complicated business, but with the help of his colleagues, whom he invited to his holiday-home in the Lakes, it was gradually, as he says, "licked into shape," the last touches to its recommendations being made at the Chairman's country house in Devonshire.

During the ten years that followed the publication of the Report, Roscoe, in common with several of his colleagues, addressed innumerable public meetings throughout the country in order to make its lessons as widely known as possible. The work of the Commission bore fruit in the Technical Instruction Act of 1889, and still later and to a greater extent in the Education Act of 1902. This last measure was preceded by the Royal Commission on Secondary Education, of which Roscoe was a member under the chairmanship of the present Lord Bryce. In 1896 he introduced a strong and representative deputation to urge upon the Lord President of the Council the desirability of taking steps to enforce its recommendations. It was then intimated that it was the intention of the Government to introduce legislation dealing with the organization of our secondary schools—thus foreshadowing the Act of 1902.

Although more than thirty years have passed since the Report of the Technical Instruction Commission was issued, it may still be read with profit. Indeed, the lessons it teaches are singularly applicable to the present juncture. In spite of what has been accomplished, Roscoe was far from being satisfied with our national position. In 1906 he wrote:

The Right Hon. Sir Henry E. Roscoe

Much remains for us in England to accomplish in the organization of our secondary and scientific training, in which our competitors are before us, and of which the importance and the effects are well summed up in the following opinion of an eminent German manufacturer: "We in Germany do not care whether you in England are Free-traders or Protectionists, but what we are afraid of is that some day your people will wake up to the necessity of having a complete system of technical and scientific education, and then with your energetic population, with your insular position, and with your stores of raw material it will be difficult, or it may be impossible, for us to compete."

In 1884 a knighthood was conferred on him, as stated in Mr. Gladstone's letter when intimating the Queen's pleasure, "in acknowledgment of his distinguished service on the Technical Education Commission."

Roscoe has recorded in his autobiography the circumstances, altogether unexpected by him, which led to his introduction to active political life. He was elected for South Manchester—a constituency largely composed of the upper and middle class—in 1885, the first Member of Parliament for the division in which the University is situated and the only Liberal then returned for the city. He held his seat during two succeeding elections (1886 and 1892), but lost it in 1895, by a narrow majority, to the Marquis of Lorne. Although frequently solicited to re-enter Parliament he felt, to use his own phrase, that he "had had enough."

Roscoe was a strong and consistent Liberal, a member of the Manchester School of Economists, and a devoted adherent of Mr. Gladstone, whom he followed in the Home Rule split. During the

greater part of his parliamentary career, that is from 1886 to 1892, he sat on the Opposition benches, and had therefore comparatively little opportunity of accomplishing much in the way of legislative achievement. On questions involving scientific matters he could always secure the ear of the House, especially when these related to the comfort and well-being of its members, as when he took in hand the ventilation, lighting, and drainage of the Palace of Westminster. In 1888, and again in 1889, he introduced a Technical Education Bill, but it failed to reach the statute-book. In the latter year, however, the Government passed the Technical Instruction Act already referred to; this, although not wholly in accord with the views he had put forward, he gladly accepted as a satisfactory instalment. His efforts to pass an amending Bill in the following year met with no success. In 1891 the National Association for the Promotion of Technical Education, which was founded as a result of the Report of the Royal Commission of 1881, entrusted him with a Bill to remove certain disabilities which had been found to attend the working of the Act of 1889, and this he succeeded in carrying. It was one of the few private Bills of the session of 1891 that became law.

He was frequently called upon to serve upon select committees, and in his last session he was Chairman of the Select Committee on Weights and Measures which led to Mr. Balfour's Bill for legalizing the use of the metrical system in this country.

Roscoe was a Vice-President of the Decimal Association, and lost no opportunity of advocating the use of a system of weights and measures

which practically every other civilized community has found it expedient to adopt. The reform of the method of holding parliamentary elections, continuation schools, opening museums on Sundays, the housing of the science collections at South Kensington, grants to University colleges, industrial employment in Ireland, limitation of moisture in weaving sheds, river pollution—were all questions upon which he was able to exercise his influence and knowledge, and most of which he lived to see satisfactorily settled. But, on the whole, he found little satisfaction in his parliamentary life. There was much in it that was irksome and distasteful to a man of his active and independent mind. It was unfortunate for him that the greater part of his political career should have to be spent in opposition, thus affording him only limited opportunities of initiating legislative action. Owing to the political circumstances of the time many questions with which he was specially qualified to deal never came up for consideration. Others were only discussed for the purpose of "marking time," and he deplored the loss of opportunity and waste of effort thereby involved. His rejection in 1895, therefore, occasioned him no very great concern. Whatever feeling of disappointment he may have felt soon passed away, and he quickly went back to his old occupations, and to pursuits more congenial to him than haunting the precincts of the House of Commons. The following letter from Woodcote, under date July 20, 1895, affords some indication of the way in which he regarded the loss of his seat.

Many thanks for your kind note. As you surmise, I do not feel personally much regret at my own defeat. I could tell you something of the way the thing was worked.

Now I feel an "old freeman," and able to do much more what I like. But this not always—for I do not see my way just now to accept your invitation. I have been worked up with the election, and have to be careful, so that with this, and with the present uncertainty of weather, I think I am safer on entire dry land.

We are thankful for rain which loveth the thirsty land and makes things green again.

Is it true that the "burning bush" manufactures C_2H_5OH [alcohol]? If so, that is really interesting.[1]

Harden and I have found some most interesting results as regards the genesis of the atomic theory, and I am going to work them up.

How about Davy? . . . The editor asks for more, and I should be pleased to satisfy his maw by giving him a lump of Davy. Kindest regards.

Shortly after his removal to London he became interested in the sewage problem of the Metropolis, and was called upon to advise the Metropolitan Board of Works with respect to methods for improving the condition of the river Thames. In connection with this work he established a laboratory, specially equipped for studying its problems, in the Earl's Court Road, not far from his London residence. During the year 1887 he was engaged, with the assistance of his former pupil Mr. Harry Baker, in reporting to Lord Magheramorne, the Chairman of the Metro-

[1] This query refers to the circumstance that at the time Lady Roscoe was growing *Dictamnus Fraxinella*—the so-called "burning bush"—for the writer, who had undertaken to investigate the cause of the phenomenon which has given the plant its trivial name. The ready inflammability was found to be due to the accumulation in the vesicles on the flower-stems of small quantities of an essential oil.

politan Board of Works, on the chemical methods employed for the deodorization of sewage (*a*) in the metropolitan sewers, and (*b*) at the outfalls. Early in 1888 much larger problems were submitted to him: viz. the purification of the sewage, the disposal of the sludge, and the effect of the discharge of sewage sludge at sea on the foreshores of the estuary of the Thames. In connection with these subjects he became impressed with the importance of obtaining accurate scientific methods for determining the changes which polluted water experiences during its natural purification. Some of the results of his inquiries he published in conjunction with his pupil Mr. Joseph Lunt in two memoirs, one "On Schützenberger's Process for the Estimation of Dissolved Oxygen in Water," communicated to the Chemical Society in 1889, and published in the *Transactions*,[1] and the other entitled "Contributions to the Chemical Bacteriology of Sewage," which appeared in the *Philosophical Transactions of the Royal Society*.[2] The former paper contained the results of a careful investigation of the conditions under which this method is alone trustworthy, and served to explain the causes of the discrepancy between the statements of previous observers who had critically examined it. The latter paper gave the results of a protracted examination of the chemical and bacteriological phenomena of crude sewage with the object of

[1] "On Schützenberger's Process for the Estimation of Dissolved Oxygen in Water." By H. E. Roscoe and Joseph Lunt. *Chem. Soc. Trans.* (1889), LV. 552.

[2] "Contributions to the Chemical Bacteriology of Sewage." By H. E. Roscoe and Joseph Lunt. *Phil. Trans.* (1891), CLXXXII. pp. 633–664.

ascertaining the species of organisms present, both pathogenic and saprophytic, and of determining their chemical characteristics.

These investigations were carried on for more than two years, concurrently with the technical and outside work required. During this time purification works had been established at Crossness and Barking outfalls, a sludge ship had been provided for the disposal of the sewage sludge at sea, and the effect of the discharge had been studied in the lower reaches and estuary of the Thames, and a chemical survey of the condition of the foreshores had been completed. But the formation of the London County Council, with Lord Rosebery as the first Chairman, involved new arrangements. This circumstance, combined with the death of Sir Joseph Bazalgette, the Chief Engineer, and the opposition of the Labour Party, resulted in Roscoe resigning his post as Scientific Adviser.

Mr. Lunt transferred his services to the British Institute of Preventive Medicine, but Roscoe continued to carry on his laboratory with the assistance of Mr. Frank Scudder until 1898. During this period he acted as chemical adviser to sanitary authorities all over the country on questions of sewage purification and water-supply; and was frequently consulted by manufacturers on works-processes, and on legal, patent, and trade-mark cases, and in connection with parliamentary inquiries, e.g. humidity and purity of air in textile mills, flash-point of paraffin oils, etc. He was further concerned in the promotion of Bills for the creation of rivers boards, as, for example, those of the Mersey and Irwell and West Riding. He gave considerable

attention to the question of the manufacture and use of water gas ("carburetted" and "blue" gas), and inspected most of the water-gas plants then in operation in England and on the Continent, sending Mr. Scudder to visit and report on the installations in the principal cities of America. In 1898 they both gave evidence before a Parliamentary Committee on the question of restricting the amount of the poisonous carbonic oxide in town gas.

In 1891 Roscoe's services were retained by the Mersey and Irwell Joint Committee to report on the influence of the various manufacturing works in the Mersey and Irwell basins in polluting the streams, and as to the best means of preventing it. In 1893 the Committee made the position of Scientific Adviser a permanent appointment, and established a properly equipped laboratory in Manchester in connection with its work. Roscoe retained the appointment until 1905, when the frequent journeys to attend the meetings of the Joint Committee began to tell upon his health, and at his suggestion Mr. Scudder was appointed to succeed him. The London laboratory was given up in 1908.

CHAPTER XI

UNIVERSITY OF LONDON—ETON COLLEGE—UNIVERSITY COLLEGE OF DUNDEE—SCOTTISH UNIVERSITIES COMMISSION—ROYAL COMMISSION OF THE 1851 EXHIBITION—CARNEGIE TRUST: SCOTTISH UNIVERSITIES—SCIENCE AND ART DEPARTMENT: SCIENCE MUSEUMS—LISTER INSTITUTE OF PREVENTIVE MEDICINE

Roscoe was long and honourably connected with the University of London. A graduate in 1853, he acted as examiner in chemistry from 1874 to 1878. It was largely through his action that practical laboratory work was included in the curriculum in chemistry for science degrees. This not only greatly enhanced their status, but reacted beneficially upon the general character of laboratory instruction throughout the country. On relinquishing parliamentary work he became a member of the Senate, and took part in the movement for the reform of the University which led incidentally to the formation of an association of teachers and others for the promotion of a so-called Professorial University, of which Huxley was President. The following letter refers to this circumstance:

MANCHESTER,
June 26, 1892.

I am delighted to hear that Huxley has joined and is to be President of the Association. It will give me pleasure to act as a Vice-President with Jebb.

Things look very well, and our views must greatly influence the Royal Commission.

I will try to secure names here. My wife sends a list per parcel post.

He made proposals with the idea of uniting what have come to be called the Internal and External sides of the University, and in his evidence before Lord Cowper's Commission he suggested a machinery of a less cumbrous and, as he hoped, of a more satisfactory character than that which became law in 1898. In 1896 he succeeded Sir Julian Goldsmid as Vice-Chancellor. It was during his term of office that the Act of 1898, which reconstituted the University as the result of Earl Cowper's Commission, was passed. As Vice-Chancellor it became his duty to watch the progress of the measure, and to use his influence in promoting its passage through Parliament.

Unfortunately the University was as a house divided against itself. One section of its Senate, numerically not very strong, was avowedly hostile to its reconstitution as a teaching body. Some members of Convocation acted as if their conception of the sole purpose of a University was the holding of examinations and the giving of degrees. Their object, apparently, was to strengthen by all possible means the influence of Convocation; to make it, in fact, the main controlling power. Accordingly, they used such parliamentary support as they could command to wreck the Bill, or failing that, so to

modify its provisions as to preserve as far as possible the existing constitution of the institution, and to perpetuate its restricted functions. Thanks, however, to the action and alertness of Lord Bryce, Lord Haldane, Sir W. Priestley, and Sir John Gorst, and the firmness of the Government, the measure was steered safely through Parliament and received the Royal Assent.

The statutory commission which followed the University of London Act of 1898 reported in 1900; its provisions were approved by Parliament in June of that year, and the new Senate held its first meeting in the following October. Roscoe took an active share in the rearrangements consequent on the reconstitution of the University, and in the changes necessitated by its removal from Burlington Gardens to the buildings of the Imperial Institute at South Kensington.

This last step was a somewhat delicate matter. As housed in Burlington Gardens the University was only moderately well provided for as regards examination-rooms and administrative offices, but such laboratories and store-rooms as it possessed were wholly inadequate for the practical work required in the examinations for science and medical degrees. The pressure on the limited space grew more severe each session, and for some time previous to 1898 the necessity of making fresh provision had forced itself upon the notice of the authorities. The wants of the University in this respect had been freely ventilated in the course of the discussion on the Bill. Accordingly, overtures were made to the Senate to take over some portion of the building of the Imperial

Institute as a home for the reconstituted University. The offer was not received with any great enthusiasm. The Imperial Institute had not fulfilled the anticipations of its projectors; its associations, to say the least, were not altogether academic, and this circumstance naturally created a prejudice against it. Moreover, the building itself, although grandiose in design, and possessing an admirable façade, was rather like the geometrical definition of a line—length without breadth; and when that portion of it intended to be assigned to the University was measured up, it was actually not much, if any, larger in superficial area than was available in Burlington Gardens. There was, however, more space in the neighbourhood, and a certain amount of rearrangement and new construction was possible. Moreover, the authorities of the Science and Art Department were projecting new laboratories for chemistry and physics, and it was hoped that facilities might be granted to the University to enable them, under certain conditions, to use them, or some portion of them, for their practical examinations in those sciences. But objections were raised in regard to the geographical position of the building, its distance from the main-line stations, etc. Its possible association with what was styled "the South Kensington clique" was another rock of offence.

There were possible difficulties also with the Council of the Institute as to the partition of the structure, use of the main entrance, etc. But all these matters were adjusted eventually by the skill, tact, and firmness of the Vice-Chancellor, with the concurrence of the Treasury and of the Office of Works; and the

University entered into the possession of the eastern half of the building.

Not the least of the services which Roscoe rendered to the University was his action with regard to the selection of the late Sir Arthur Rücker as its first Principal. It was entirely through his efforts that the appointment was made. Its success, he says in his "Life and Experiences," more than justified those efforts, and he always spoke of it as the best day's work he ever did for the University.

Roscoe resigned the Vice-Chancellorship in 1902, when he presented to the University the handsome mace which now lies on the table during the meetings of the Senate, and which is used on ceremonial occasions. It was so employed, draped in crape, at the memorial service held in Rosslyn Hill Chapel at his death.

He remained a member of the Senate until 1910, when age and increasing deafness necessitated his retirement. In the resolution of condolence which the Senate passed at its first meeting after his death, they recalled with gratitude and admiration the great services he had rendered to the University during the twenty-one years of his membership of the Senate, at first as Fellow and later as one of the representatives of His Majesty in Council; and especially the wisdom, born of long experience in academic administration, with which he guided the University during the six years of his Vice-Chancellorship, which witnessed its reconstitution under the Act of 1898.

Roscoe was a Fellow of Eton College, as a representative of the Royal Society, from 1889 to 1912,

and did what he could during the twenty-three years he served on the Governing Body to overcome what he terms "the enormous inertia of this ancient machine." He sought to further the teaching of physical science in the School by himself giving lectures, and through his efforts it is the richer by no less than one large and one small physical laboratory, a physics lecture-room, a workshop, and two more chemical laboratories, with store-rooms, etc. He also reorganized the system of teaching, and introduced graduated courses, which have resulted in an all-round improvement. Nevertheless, the results have not been commensurate with all the hard work and enthusiasm he put into his efforts. They have been largely discounted by factors over which he had no control. No one realized this more clearly than himself, and he felt keenly the disappointment of his hopes, so much so that more than once he considered the advisability of resigning his Fellowship as a protest. He earned the gratitude of the science staff by his uniform kindness and sympathy, and by the readiness with which he would discuss their difficulties with them and help them with advice and encouragement.

As the representative of the Royal Society, his chief interests lay with the teaching of physical science, but they did not rest there. No Fellow worked harder for the general welfare of the School. In order to make himself acquainted first-hand with facts connected with the subjects to be discussed at the meetings of the Provost and Fellows, he constantly visited Eton. His opinion and advice on all sorts of questions were sought and respected, and he has left behind him a record of whole-hearted

service to the School that will long be remembered with appreciation and gratitude.

Roscoe's experience as an educationist, and his success in furthering the development of Owens College, naturally caused him to be consulted when institutions of a similar type were projected, and he was occasionally induced to take part in their foundation and government. Thus he had a large share in the arrangement of the curriculum of the University College of Dundee in 1881, and he was afterwards concerned, as a member of the Scottish Universities Commission, in establishing the connection of that College with the University of St. Andrews. He was appointed by the Duke of Devonshire to a governorship of University College, Liverpool, a position particularly gratifying to him as a member of a distinguished Liverpool family. He represented the University of London on the Council of Firth College, Sheffield, which has since risen to the dignity of a university, and was of service with respect to its science curriculum.

In 1888 Roscoe acted as a member of an Executive Commission appointed to carry out the provisions of the Scottish Universities Act. The Commission succeeded in devising ordinances which in many respects revolutionized the systems of the Scottish Universities, and by providing new avenues to degrees are destined, it may be hoped, to have an important effect upon the character of scientific education in Scotland.

In 1890 he was appointed a member of a Committee along with Lord Playfair, Lord Kelvin, Pro-

fessor Huxley, Mr. Mundella, Sir Norman Lockyer, and Dr. William Garnett, to advise the Commissioners of the 1851 Exhibition on the question of establishing scholarships to aid the development of scientific education in the manufacturing districts of the country.

Roscoe remained a member of that body after it had presented its Report and had been entrusted with the duty of putting into operation the scheme which had been devised for the distribution and regulation of the scholarships. The character of these scholarships cannot be better described than in his own words :—

It was decided that these should be of a higher order than most of those existing; in fact, that their functions should begin where the ordinary educational curriculum ends, this system having been adopted with excellent effect in the French *École Pratique des Hautes Études*. In other words, the scholarships were to be entirely confined to research, and strict conditions were laid down as to the capability of the candidate to carry out original investigation. The scholarships were to be £150 a year in value, tenable for two years, and to be limited to those branches of science the knowledge of which is specially important for our national industries. The Commissioners from time to time were to select a number of institutions throughout the Empire in which high scientific instruction is given. Each university or college was to have the power of nominating a student to a scholarship on the condition that he exhibited a capacity for advancing science or its applications; these scholarships, when awarded, were to be tenable in any university, either at home or abroad, or other approved institutions. . . .

The fact that a large number of the nominating institutions are situated in the colonies, and that the scholars from these institutions come to the mother-country to carry out their scientific work, must exert an important influence in strengthening the relations between different parts of the Empire. The value of this system is fully appreciated by the authorities at home and abroad, and many are the instances in which men of ability, who would otherwise have been unable to follow a scientific career, or to assist the progress of

our national industries, are now coming to the front in both respects. It has been well remarked that if, in the course of a century, even one Faraday should have been discovered, the sum spent would have been amply repaid.

The policy laid down by the original committee has since been pursued without essential variation, and what was at first regarded as an educational experiment has proved itself by the test of time an entirely successful undertaking, and one which has served as a model for the institution of similar foundations, both in this country and abroad.

In recognition of the services rendered on this committee, Roscoe was elected, in 1891, a member of the Royal Commission, and five years afterwards, in 1896, he became a member of the Board of Management, and at the same time succeeded Lord Playfair as Chairman of the Scholarships' Committee.

As Chairman, the control and direction of the Committee's work was very largely in his hands, and the care he devoted to every detail of the scholarship work undoubtedly contributed to the successful operation of the scheme.

But there was something more to value (says Mr. Evelyn Shaw, who contributes the above particulars) than the part he played in the proceedings of the Committee. The charm and sympathy of his personality were felt by so many scholars who had occasion to consult him upon their work, and who often afterwards remembered and were grateful for some kind and helpful advice. He never failed to watch with interest the careers of past scholars, as he regarded their record as the most convincing proof of the value of the Commissioners' Endowment.

In 1901 he consented, on the invitation of Lord Elgin, the Chairman, to join the executive committee

of the trustees appointed to carry out the administration of Mr. Andrew Carnegie's munificent gift to the Scottish Universities for the benefit of scientific education; and he assisted in the inauguration of a system of Carnegie Scholarships and Fellowships for the encouragement of original investigation, resembling that of the Royal Commissioners of the 1851 Exhibition.

Roscoe acted as chief examiner in chemistry of the Science and Art Department in succession to the late Sir Edward Frankland, but resigned the appointment on his election to Parliament. He took a great interest in the aims of the department, and worked cordially with its administrative officers, especially in the abolition of the old system of "payment on results" for the elementary stage of science subjects, and in remodelling organized science schools.

The importance of properly housing the valuable science collections at South Kensington was constantly being pressed by him upon the Government. In 1909 he accompanied a strong deputation, and presented an influentially signed memorial to the Board of Education, pleading for larger and better accommodation for the unique and almost priceless exhibits of historically important objects which the museum possesses, some of which are absolutely irreplaceable. He pointed out how valuable such a collection was as an adjunct to the systematic teaching of science and technology. Each model, or piece of apparatus, or specimen of historic interest, was selected to bring into prominence underlying principles, or to illustrate various stages of industrial

progress. In the temporary buildings in which the collections were placed, there was not only no room for the necessary expansion, but the objects were so crowded together that proper arrangement and inspection were impossible. What was needed was a building adequate to the proper exhibition of the present collection, and one worthy of British Science. He pointed out that one consequence of storing the collections in so haphazard and unsatisfactory a manner was that persons possessing objects of interest naturally felt indisposed to present them to the nation, and some of these when offered had to be refused through want of space. Land sufficient for the purpose was in the hands of the Government, and the Royal Commissioners for the 1851 Exhibition, so long ago as 1878, offered to contribute £100,000 towards a building for the Science Museum. Roscoe's arguments were strongly supported by other members of the deputation, and Mr. Runciman, who was then at the Board of Education, expressed himself as convinced by their weight, and as wholly in sympathy with the object of the speakers. A gratifying result of this action is to be seen in the new buildings now in course of erection.

Roscoe's high appreciation of Pasteur's work as a chemist was, we may presume, the immediate cause of the great interest with which he had followed his remarkable discoveries concerning the causes and cure of chicken cholera, anthrax, and the silkworm disease—an interest quickened, no doubt, by the fact that he had made the personal acquaintance of that distinguished man as far back as the early 'sixties.

He had specially informed himself of the working of the Institut Pasteur in Paris, and of the anti-rabic treatment, and had borne his share in combating the mischievous prejudices of those in this country who sought to misrepresent the character and objects of Pasteur's work. In 1886 he had used his parliamentary influence to induce Mr. Chamberlain, who was then President of the Local Government Board, to appoint a Government Commission, consisting of the late Lord Lister, Sir James Paget, Professor Ray Lankester, and himself, with Sir Victor Horsley as secretary, to inquire and report on the efficacy of Pasteur's treatment of hydrophobia. The Commission came to the conclusion, based upon irrefragable proof, that this treatment had been the means of saving a large number of lives that otherwise would have been sacrificed to a dreadful and torturing death. Their report induced Sir James Whitehead, when Lord Mayor of London, to call a Mansion House meeting for the purpose of raising a fund partly to defray the cost of sending poor persons, who may need treatment, to the Pasteur Institute in Paris, and partly to repay some of our indebtedness to Pasteur and his co-workers for having treated some two hundred of our countrymen gratuitously. The Royal Society requested Roscoe, with Sir James Paget and Professor Lankester, to represent them at the Lord Mayor's meeting, and they supported the action by a formal letter from the President. Roscoe seized the opportunity of having to respond for "Science" at a Royal Academy banquet to direct further attention to the subject, and he subsequently spoke in the House of Commons of the great value of experiments on living

animals in opposition to an amendment designed to impede the working of the Vivisection Acts. By memorials, popular lectures, and articles in the periodical press, he kept the subject continually before the public eye. Nor were his colleagues less active in instructing and forming public opinion. Their efforts eventually resulted in the establishment of an institute in London with aims similar to those of that in Paris. Thanks to the munificent action of Lord Iveagh, it has been housed and equipped not less worthily than its sister foundation. The London Institute of Preventive Medicine now bears the honoured name of Lord Lister, its first President.

Roscoe was its Treasurer from 1891 to 1904 and Chairman from 1904 to 1912, and again from 1914 to the time of his death. The building has now been completed at a cost of £28,000, entirely paid out of income, and there has been a gradual and considerable increase in the scientific staff and in the volume of work done. The formation of the Medical Research Committee was thought by Roscoe to affect the interests of the Institute, and he considered that it might be better to bring about a working arrangement between the two bodies. He felt that the independent existence of two such schemes of research might lead to rivalry rather than to co-operation, and that the superior resources of the Government Committee might operate to the disadvantage of the Institute. It was also thought that the addition of the resources of the Institute to those at the disposal of the Committee together with the union of the two scientific staffs would prove a great advantage to each and contribute largely to the success of both. Another

more practical point was that the amalgamation scheme would remove from the Institute the burdensome necessity of having to earn money by routine diagnosis work in order to provide a sufficient income to support the scientific work, and to permit of its increase. This contemplated action gave rise to a considerable difference of opinion. As a question of policy it obviously admitted of two sides, and when the matter came up for decision the preponderating feeling was to let well alone and to allow the Institute to continue to develop along independent lines.

CHAPTER XII

DIGNITIES AND HONOURS—THE *DEUTSCHE REVUE*—GERMANY AND ENGLAND—WORLD SUPREMACY OR WAR

Roscoe's services to science and to the cause of education were widely recognized. He was an honorary graduate of many universities at home and abroad, and an honorary or corresponding member of many foreign scientific societies. He was a D.C.L. of Oxford; and LL.D. of Cambridge (1883), Dublin (1878), Glasgow (1901), and Montreal (1884); and D.Sc. of Aberdeen, Liverpool, and Victoria. On the occasion of the eighth jubilee of the foundation of Heidelberg University he was made an honorary M.D.

He served as a member of the jury for chemical products of the English section of the French Exhibition of 1878, and was made an officer of the Legion of Honour, and in 1889 a corresponding member of the French Institute of the Academy of Sciences. He was an honorary member of the American Philosophical Society of Philadelphia and of the New York Academy of Sciences; of the Chemical Society of Berlin; of the Bunsen Gesellschaft, of the Verein für Naturwissenschaft of Bruns-

wick, and of the Physikalische Verein of Frankfort; a corresponding member of the Bavarian Academy of Sciences of Munich, of the Royal Society of Sciences of Göttingen, of the Royal Accad. Lincei of Rome, and of the Academy of Natural Science of Catania; a member of the Leop. Carol. Akad. of Halle, and of the Physiogr. Sällsk of Lund. He was an honorary member of the Royal Irish Academy, and of the Literary and Philosophical Society of Manchester. In 1912 the Franklin Institute awarded him the Elliott Cresson Gold Medal.

He was sworn of the Privy Council in 1909—an honour which he accepted not only as a personal distinction but as a recognition of the claims of Science.

But of all the distinctions and marks of appreciation he received in the course of his long and busy life, none afforded him a truer or more heart-felt gratification than the action taken by his old pupils in celebrating the fiftieth anniversary of the date—March 25, 1854—on which he took his Heidelberg degree. The warmth and cordiality with which the idea of commemorating his jubilee was received, not only by his former students but by every teaching institution, academic body, and scientific society with which he was or had been connected, was a striking testimony to the regard and esteem in which he was universally held. The University of Heidelberg renewed its diploma of Doctor Philosophiæ Naturalis, and accompanied it by an address from the Grand Duke of Baden, Rector of the University, the Pro-Rector, Senior Dean, and the other professors of the Philosophical Faculty. Addresses were also sent by

University College, London, the Victoria University, and the Universities of London, Liverpool, Birmingham, Wales, Scotland, Montreal, Melbourne, New Zealand, and Tokyo; King's College, London, the Yorkshire College, and the University Colleges of Sheffield, Newcastle, and Dundee; the Royal and Chemical Societies, the Society of Chemical Industry, British Association, the Lister and Pasteur Institutes, and a number of the academies and scientific societies of Germany, Italy, Holland, and America. In addition a large number of congratulatory letters and messages were received from distinguished friends, chemists, and physicists throughout Europe, America, and the British Dominions beyond the Seas.

The celebration was held on April 22, 1904, in the beautiful Whitworth Hall of the Victoria University in the presence of a large and enthusiastic gathering of former students and colleagues, and of friends who had journeyed to Manchester to present addresses.

Of all these addresses, the one, he says in his autobiography, that touched him most nearly was that from his former pupils. It ran as follows:

We, the undersigned, all of whom have the honour to number ourselves among your pupils, desire on the occasion of the celebration of the Fiftieth Anniversary of the date of your graduation as a Doctor of Philosophy of the University of Heidelberg to offer you our hearty congratulations, and to express our pleasure that you are able to be with us in health and strength to receive this testimony of our gratitude and esteem.

The half-century which has elapsed since the day of your Doctor promotion *summa-cum-laude*, has witnessed an extraordinary development in that branch of natural knowledge to which you have particularly devoted yourself. We recall with pride in how large a measure your own labours have contributed to that growth—by your

work as an original investigator, by your literary productions, by your remarkable and almost unexampled success as a teacher, by the influence you have exerted in the organization and direction of societies concerned with Science, by your unceasing and well-directed efforts to secure for Science its due position in the scheme of National Education and the fuller recognition of its relations to the well-being of civilized communities. It was your good fortune at the outset of your career to come under the influence of illustrious chemical philosophers—Graham, Williamson, Bunsen. Your good fortune has been our great gain. You have not only worthily upheld the traditions associated with such names, but you have inspired others by your example. Your influence is to be seen in the creation of the great School of Chemistry in which you have laboured for thirty years, and in which you taught hundreds of pupils; it is equally felt in the many similar places throughout this kingdom which are modelled upon the lines you indicated, and which are to-day actuated by your method and example.

We gratefully recall the obligations that we are under to you as our teacher, and we cherish the memory of the signal services you have rendered to the Institution of which we are proud to be members. You came to it in the days of its precarious infancy, you assisted to rear it into a vigorous youth, sharing its aspirations, and stimulating its endeavours; you behold it now of age, and entering upon a great career.

That you should have lived to see and enjoy this fruition of your labours is a matter of special gratification to us, as it must be to you. Blessed with continuing health and happiness may you long be spared to witness its growth in prosperity and usefulness.

To this address he replied:

Of all gratifying and far too flattering addresses which I am to-day receiving, none come so near my heart as that signed by three hundred of my former students.

What can a teacher value more than the sympathy and good opinion of his pupils, and this you have given me in full measure.

If I succeeded in forming a School of Chemistry at Owens, it was because, in the first place, I learnt from Bunsen how the foundations of such a school must be laid; secondly, because I fortunately secured the co-operation in the task of good men and true, like Schorlemmer and Dittmar; and last but not least because I was

surrounded by an ever-increasing band of young men imbued with the true scientific spirit, able and anxious to devote themselves to the study and to the advancement of their science.

Well aware of my own deficiencies, and recognizing the gulf which lies between promise and performance, I yield to none in the personal interest which I take in your progress and welfare, and in the affectionate remembrance in which I hold each and all of you. Many, many thanks.

In his later years, and when the physical disabilities of age kept him more and more indoors, Roscoe occupied himself in contributing short articles to the *Deutsche Revue* on academic or educational subjects. Thus in his first article he recalls his Heidelberg experiences, and dwells upon his friendly relations with German men of science, dating from the early 'fifties of the last century. In a second article he describes the rise of the English Universities—ancient and modern—their characteristics and the differences in constitution and methods between them and the German Universities. In 1908 an article entitled "An English Man of Science on the Friendship of the German Emperor for England and upon the relations of England and Germany," indicates a certain feeling of anxiety at the growing unrest he perceives in reference to Germany's intentions in so rapidly increasing the strength of her fleet. He follows this up with a longer article on "The Peace Mission of the Sciences," in which he expands a favourite theme to which, to our grief, circumstances have now given the lie direct. In quick succession he writes letters to the editor on "A few words concerning England and Germany"; "International Understanding"; "No more War in Europe"—in which he strives to remove misapprehension, and to

make clear to German readers that there is no widespread feeling of animosity in this country towards the Fatherland.

The following letter to the writer refers to this matter :—

. . . Has Anschütz sent you his pamphlet on Couper? It is very interesting, and places C. on a level with Kekulé. . . . I am languishing for some scientific converse. I fear no chance of seeing you at present. But I should like to!

As a *Zeitvertreib* I have written a political diatribe entitled "Es soll in Europa kein mehr Krieg seyn" for the *Deutsche Revue*. The Powers will tremble when they read it—which they won't! But the editor is pleased and calls me—or rather, I fancy, his daughter does—"Dearest Sir Henry"!

Under the title of "King Edward VII the Peacemaker" he contributed to the same review a short article written a few weeks after the King's death, in which he dilated on his high personal qualities, his merits as a ruler, and his love of order and peace. His last communication on "Germany and England" the editor declined to print, but it was published in *Nord und Sud*, an old-established and well-known fortnightly review of good repute. The article is so characteristic of the good sense and right feeling of its author that it is well worthy of reproduction, apart from its interest in relation to the one supreme topic of the time.

Germany and England.

I write neither from the point of view of a diplomatist nor of a politician, but simply as a scientific man who, being a *Menschenfreund* and *Deutsch-gesinnt* and anxious to see differences between the nations as between individuals disappear, asks himself the questions, who are the people who are stirring up all this discord;

what do they mean; what do they want; what is their power? We in England call these men Jingoes. In Germany, I believe, they are termed Pan-Germans or All-Deutschen. In France they are "Revanchistes," and in Italy "Irredentisti."

What they mean is clear enough; they mean mischief. What they want is not so plain, for they do not tell us in simple language; indeed, I doubt whether they know themselves. That their language, whether spoken or written, is more or less dangerous to the peace of the world everybody admits. What is their power, and how far that danger goes, is another question. Nobody believes that their wish to set the nations by the ears is shared by the mass of mankind. The general good sense and honesty of the people of every nationality is a strong bulwark against Chauvinism. And if the true opinion of the British and of the German peoples could be obtained who can doubt that it would be in favour of peace and good feeling rather than of hostility and war? But to err is human, and to be misled is easy, so that it behoves those who love progress and hate all that opposes progress to use all efforts to denounce and destroy Chauvinism in every country and in every form. In England Jingoism has practically no power. In Parliament certainly none—witness the speeches lately delivered in both Houses—not one note of ill-feeling towards Germany was heard. On the contrary, the warmest expressions of appreciation of goodwill and friendship fell from the lips not only of the members of the present Government in Lords and Commons, but also from the leaders of the Opposition in both Houses, and the wish for an understanding with Germany was universal and emphatic.

In the British Press, with a few dishonourable and unimportant exceptions, the same thing may truthfully be said. The working classes have never been infected by anti-Germanism. Our commercial men, who are brought into intimate trading relations with the Germans, desire an Anglo-German understanding beyond all other aspirations in the sphere of foreign policy.

To believe that England now wishes, or is likely ever to wish, to go to war with Germany is a delusion in which only the insane can indulge. What on earth, may well be asked, can England gain by commencing war with Germany? Suppose, for instance, the British fleet could bombard and destroy Hamburg; in what way would such an act of vandalism benefit us? In no possible way; on the contrary, we should be cutting our own throats, for is not Hamburg one of our best customers, merely to look at the transaction from a monetary point of view?

The Right Hon. Sir Henry E. Roscoe

Let me pull down another idol. It has been said, and is still believed by many persons who ought to know better, that England is jealous of the rising, or risen, world-wide trade of Germany, and is determined to stop it in defence of her own. That such a view has been expressed by certain of my countrymen is, of course, a fact. But surely this is a totally false view. Imagine, if you can, Germany reduced to the condition of half a century ago, poor, disunited, with little or no world-wide trade. Would English commerce be more flourishing than when, as now, Germany is rich, united, and trading the wide world over? Certainly not. The richer our neighbours and competitors become the more will our own trade benefit. A man with sixpence in his pocket is not much good as a buyer. With a handful of gold he is a welcome customer! What the trade between the two countries was worth fifty years ago I don't know, but it must have been a mere fraction of what it now amounts to, namely, over 100 millions sterling a year.

Is there any other point of view from which the notion that England can personally gain by making war on Germany can be urged? I do not know of one, and perhaps our Jingoes may even admit this. But say they: "If we do not declare war Germany is certain to do so. Is it not better for us to choose our own time and occasion rather than allow our enemy to take the step when the conditions are most favourable to them? This conclusion is sound provided the premises are also sound. Does Germany intend to declare war or so to act as to bring about a war with this country? What is the evidence? Certainly if we are to accept the statements of the All-Deutschen party as representing the opinion of the nation at large there are good grounds for believing that war is inevitable. But surely every one who knows anything of Germany and German opinion is certain that the All-Deutschen have even less power to bring about war than our own Jingoes have, and that their utterances represent public opinion in Germany to a less extent than those of our Jingoes represent the English opinion. The debates in the Reichstag, the speeches of your Ministers, the expressions in the more responsible organs of the German Press, and the outspoken opinion of the German working classes, all tell the same tale, "We do not want war."

Still there remains in Germany a strong and widespread feeling of animosity—not to use a harsher term—towards England. Upon what is this feeling based? What has England done, is doing, or is going to do that should create such a feeling of mistrust and enmity?

I have never been able to answer this question, and I believe it arises out of a misunderstanding and misconception; a sort of revival of the old French cry of "*Perfide Albion.*" Can these All-Germans point to any one of the many Anglo-German agreements which have been arrived at from the time when Germany began to expand down to the present moment which has not given Germany every opportunity to take her place in the sun?

Let me come to the point. Has England interfered with German trade? If she has, she has failed egregiously, for in spite of England's supposed efforts German trade has increased and is increasing by leaps and bounds. But what signs of interference has England shown? Can your Pan-Germans point to a single instance? It is easy to write fiery articles, and to attribute ill-feeling or jealousy, to say Germany cannot come out in the sun because Britain "rules the waves," to assert that Englishmen dislike and despise the Germans, and that we are jealous of German prosperity. This is not only foolish and unfriendly talk, but it is false from beginning to end. Instead of endeavouring to limit German trade our policy of the open door has had the effect of expanding it enormously. All our ports at home and in foreign waters, all our offices, shops, and industries are open, and educated Germans have taken great advantage of our policy both to their own and to our immense benefit. Wherever British industry or commerce flourishes there German merchants or manufacturers are found, and there they remain. In our own great cities, in those of our oversea dominions, as well as in our most distant settlements, the ubiquitous German flourishes, and is a welcome strength to the community. What more can England do to assist German trade and industry than she has done and is doing? How can it with any truth be said that England stops Germany from coming out into the sun? "Yes," these Pan-Germans may say, "we grant that you are very kind, and give us a helping hand. That is, however, not good enough for Germany. We must stand alone. We insist upon having a Colonial Empire, an Oversea Dominion, a *Deutschland über See*, as you have in Australasia, Canada, and South Africa."

Well, if these views were those of the German nation instead of that of a somewhat insignificant clique, and if Germany were to determine that at all hazards this wish must be fulfilled, the question would at once become of grave importance, because that would mean certain war with Britain, and probably with the United States. And for this reason England being a long consolidated great Power (*Welt*

Macht), and having had the command of the sea, and her people having the faculty of successful colonization, has, for the last four hundred years at least, sent forth peaceful armies to annex and dwell in the most fruitful and habitable—but uncivilized—parts of the world. To such an extent has this movement been successful that nearly all the areas of land not already occupied by civilized man, and capable of being made a permanent home by Europeans, have been taken over by Englishmen or Americans, so that little space of the kind is left for the young and aspiring German nation to annex. Whether for good or for evil she has come too late for this game of grab, unless, indeed, she is so rash as to try to take land from those now in possession. This, of course, entails war, and war the damage of which—even if victorious on her side—no amount of land or gold could even in a small degree repay. As to the truth of this statement, consult the Credit Bankers of Berlin, and ask them what would be the condition of the Berlin Exchange the day after war was declared between Germany and England. I, for my part, do not believe that Germany or its people are gone mad, or likely to become so, and therefore I do not believe that Germany will ever try to wrest from England her Oversea Dominions or to invade the New World with the millions of armed men necessary to establish a Fatherland in the West.

Much has lately been said about Germany being over-populated. Her people increase by nearly one million souls yearly. "Some outlet for these millions must be found," say the All-Deutsch. Is this so clear? The population of Germany is not nearly so dense as that of our own country or that of Belgium, and in both these countries the conditions of life are quite as favourable as those in the Fatherland. Moreover, is it not true that to-day thousands of workers from other lands are flocking to fill new posts created by the ever-increasing demand for labour in the German industries?

No! the high and glorious aim and true function of the German nation is not to try to conquer by the "mailed fist" either on land or sea, but to show how the world may be dominated by proving to mankind the grand results which accrue to civilization when a nation has both the power and the determination to carry out its high ideals. No other nation in either the Old or the New World possesses these ideals in such high degree, and is, therefore, so fully able and so well fitted to take the lead in this new departure as the German.

The old game of war is played out. It has become a disgraceful

instead of a glorious one in the eyes of twentieth-century men. We look to Germany to show how a modern state is to be carried on for the greatest good of its own people so as to become an example to the rest. Take the opinions of your great men of Science—men of the stamp of Helmholtz—men who looked forward instead of backwards, and be guided by them. Ask them in what is national glory to consist in the coming centuries. Do not pin your faith on those who, like Treitschke, argue that because war has been, it must continue to be, men who preach the false doctrine that its influence is a purifying one, and a saving grace. These views are those of the past. They do not represent the present, still less the future opinion of mankind.

The time is now ripe, for has not Dr. von Bethmann-Hollweg said on the part of the German people that the national slate is clean? It will be the greatest wickedness and folly of both nations if this appeal to the better feelings of the peoples is not welcomed and acted upon.

Let Germany pursue her ideals, and her actions will rule the world, because those ideals and actions make for peace and progress.

That there was a section—and a not inconsiderable section—of the German public to whom this appeal was not in vain was manifested by the publication in Stuttgart of a remarkable article on "World Supremacy or War," written under the *nom-de-plume* of "Nostradamus." This so impressed Roscoe that he translated it for the British-German Friendship Society—a society of influential persons who strove to stem the rising tide which broke down all barriers on that fateful day of August 1914. The purport of the article was to point out that the true policy of Germany was to seek an alliance with England. The writer admitted that we were the first to offer the hand of friendship, but that under Bülow's *régime* it was declined. He further shows it was this circumstance that led England to seek alliances elsewhere—an action that was not only natural but essential to

our well-being, and wholly due to the short-sighted policy of Germany. The pamphlet is too long to be quoted in full, but a few extracts, read in the light of what is happening, may be of interest.

WORLD SUPREMACY OR WAR.

. . . We have often enough declared that we never mean to attack England. Does any one imagine that a prudent nation will trust to such words when it comes to a question for her of to be or not to be? What is it those Britons see who have been following with interest for twenty years the events which have taken place in our country? A steady and continuous increase of armaments; a fleet born and growing each year more and more rapidly; a ruler who is restlessly active—now in the saddle, now on the captain's bridge; his palace only used for sleeping. Wherever the Kaiser goes his forces are in the forefront. Exercises, manœuvres, mobilization of the fleet, war games, conferences, and speeches quickly follow one another. His speeches refer oftener than needful to the grip of the sword, and at the same time he sedulously endeavours to negotiate personally with his neighbouring States. Such things as the Kruger telegram and the expedition to Tangiers look like froth, but they really hide personal wishes and inclinations. Thus do the English see us. What can they, what must they think of it all? We are grown to be neighbours and yet we arm and arm. Our trade is protected, and for offensive purposes a fleet will arouse little sympathy. Have not both Holland and Belgium a large trade and yet no one thinks of wresting it from them.

Against what is Germany arming if not against England's command of the sea? Must not every Englishman think so? Has not their mistrust been fostered by our policy, by the utterances of our men of mark, by the opinions of our Press, and last but not least by the propaganda of our Navy League?

How can a clear-headed people like the English entertain friendly feelings for us in view of these evident proofs of our mistrust? We have driven England into the Double Alliance. "He who is not with me is against me." Should we not do exactly the same? We carry on a sentimental policy, play the injured party, whilst suspicion prevents us from being open-minded.

The German Empire ought therefore only to have a fleet sufficient for her real needs, able to defend her coasts, to act as maritime

police in the areas of smaller States, and to perform convoy duty for our troop-ships to our colonies. A larger fleet is in fact either a luxury or it is directed against England. Such logic is inexorable. For our centre of gravity—otherwise than is the case with England—lies at home. We are not dependent on the importation of food-stuffs; the 5 per cent. of what is not grown on our own soil must be sacrificed in war.

As to our commerce, there will be no dispute. In the countries where our goods are sold the German merchant is not only a necessity but valued as an indispensable friend and educator. The merchant who is not able to create such a position is not worth having battleships near him to back up his weaknesses. Only the excellence and tastefulness of the wares he has to sell and the tact and ingenuity of the seller, coupled with a full knowledge of local requirements, can ensure the prosperity of our commerce; never the mailed fist! This cannot be repeated too often or too emphatically.

Up to now the agreement with France and Russia has guaranteed England's safety. Now England sees that France, relying on the military convention with her two friends, is working seriously for war. She knows that in Russia the voice for war against Germany is increasing. Such a war would weaken England's Navy; it would throw a hundred and fifty thousand Englishmen on the battlefield;[1] it would mean heavy demands on the country's finance and her colonies might make threatening movements against her sovereignty. She would also lose her best buyer and seller. Europe's predominance would be imperilled!

These are the weighty reasons why the English Government are trying—even at the eleventh hour—to prevent this war.

Many object that the psychological moment will not arrive for this war. Internal conditions will tend to promote it. Never have the opportunities been so favourable for the French and Russians to cross swords with us, and to endeavour to annihilate our position as a leading Power of the Continent.

France sees her population going down year by year. In the same ratio the prospect is dwindling for France to regain Alsace Lorraine and thereby increase of dominion, population, and prestige. The hatred of the conqueror continues to blaze; they have long since lost all respect for us, and they are longing to measure their strength with

[1] It has thrown upwards of five millions.

ours. Newspapers and leaflets stir up the flame and preach *ceterum censeo.*

The Republic undoubtedly binds the people together more closely, and will provide more means and men for their armaments than is the case with us. And the call will not be in vain, neither are Alliances nor Military Conventions. Russia's Army and England's fleet, plus 150,000 men, are guaranteed to France. Italy is tied up in Tripoli, the North Sea Canal is unusable, a third of the German voters have shown themselves as enemies of the State, and party disputes have demoralized the nation. When will such a concatenation be repeated?

And what is the outlook for Germany?

Do not let us fear to look the matter straight in the face. A war on three sides. Our Navy against three Navies, and a triple superiority. Victory at sea is impossible. However much we may harm our opponents we are certain to lose many colonies. On the mainland fighting on two flanks. Of course we cannot deny it and must look at the future coolly. It is idle to waste words about such a war; let us leave talk to others. Let us look at a favourable solution: the defeat of both opponents. What would peace bring us? Annexation of more French or Russian possessions? No rational being could think of such a poisoned gift.

And what about overseas and colonies? In foreign parts we shall have nothing more to say, for our mercantile and naval fleet will be almost entirely destroyed. And as for money indemnity, even in case we conquered our opponents we cannot hope for heavy terms. We shall be glad after this blood-letting to embrace peace and to receive a portion of our war expenses. We should have to fight hard, and only through rivers of blood and by straining every nerve can we hope to keep our Empire intact. In the 1870 war against the French Empire in nearly every case our victories were bought with superior losses. And how dear these victories cost us!

But not numbers, nor weapons, nor careful preparations in times of peace are going to conquer in the war of the future. *Esprit* alone will turn the scale, and to quote the words of Frederick the Great, "The *esprit* of an army lies in its officers." Those officers will have the best influence on their men who have the most hardened physique and who are trained each one according to his particular bent, and are able to do without comforts and have the natural gift of comradeship with the common soldier combined with strict discipline. They must evoke the soldiers' esteem and dependence and

the blind trust which the unselfish care of their men will produce. This can be brought about only by placing the well-being of the troops in the forefront, and without the slightest consideration on the officers' part for their own advantage, unselfishly sinking their personality, rising to every situation with courage, and bracing up every weakling or coward under their care by their example. That corps which possesses these qualities to the fullest extent will carry victory with their colours, and only such a set of officers can be our salvation.

Do not let us underestimate our opponents.

On the west we have the French Army with a lurking desire for revenge, its material intelligent and full of soldierly qualities. The sons of the Republic will fight with the same courage they did in the 1870–1871 campaign but under better generalship. The French have learnt a great deal; may we not admit this to-day?

And how is it with us?

An admission must be made at a critical moment. That moment has arrived. In the course of time the sober and earnest speech and thought of the old Prussians has become remote. Let us beware of overconfidence in ourselves. We have a forty years' peace behind us, which is not very good for the German Army. So much for us.

And what will victory bring us?

The loss of our Navy and our Colonies, and our own destruction only avoided by a sea of blood. What will happen when the people return home, awakened as to their own character and chastened by a fruitless fight? We speak of a favourable result. And if this does not occur? If Germany does not win in the next war shall we be bled to death? Bismarck said this, and let us admit it openly: "In this war we have nothing to gain and everything to lose."

He who brings about this war and who does not try to obviate the danger is perpetrating the greatest outrage on the German nation. He is endangering the creation of Bismarck and his King; he is playing with loaded dice.

Here was a voice crying in the wilderness—a prophet without honour in his own country! But how true are his words!

CHAPTER XIII

HOME LIFE—LADY ROSCOE—WOODCOTE LODGE—
PERSONAL CHARACTERISTICS—DEATH

In 1863 Roscoe married the lady whom he had first met in his aunt Crompton's drawing-room in Hyde Park Square—Lucy, the youngest member of the family of Edmund Potter, Esq., M.P. for Carlisle, a well-known Manchester merchant and a friend and co-worker of Bright and Cobden.

Lady Roscoe was a strong and sincere character, of wide sympathies and generous impulses, with a rich fund of common sense, and a high standard of duty and performance. She had many intellectual interests, and a cultivated taste; was well read, a good judge of literary work, and an assiduous collector of old rare and beautiful prints. In the early days of her married life, and at a time when she had to work with wet collodion or to prepare her own dry plates, she was recognized by experts as a clever photographer, and obtained medals from the Photographic Society for the technical excellence and artistic merit of her exhibits. She was an admirable hostess, and all who have had the privilege of partaking of her hospitality cherish an unfading memory of her kindly manner,

her quiet dignity, and unfailing tact. Time dealt tenderly with her; the additional years brought an added charm, a widened sympathy, and a larger measure of gentleness and pity. With her healthful, smiling face and beautiful white hair, her characteristically simple dress and the rare lace she draped about her head and shoulders, no woman was ever more successful in the art of growing old gracefully. She died in 1910. Of this union it was said by one who had the best opportunities of judging: "Of the forty-seven years of married life one who looked on can say there never were two more of one heart and mind." The one sorrow of their lives—and it was a profound sorrow, a grief that changed the whole current of their aspirations—was the death of their only son when an undergraduate at Magdalen College, Oxford, just as he was entering on manhood. He was a young man of great charm of manner, of high ideals, and a strong sense of duty and responsibility, and with the ambition to serve in a career of public usefulness or in some position in which his well-marked powers of literary expression might be turned to account. Two daughters were also born of this marriage, the elder of whom married Mr. Charles E. Mallet, formerly M.P. for Plymouth and Under-Secretary for War in the last Liberal Government.

Nowhere did Roscoe appear to greater advantage than in his home. His domestic life was singularly unclouded save for the one great sorrow "that failed the bright promise of an early day." He had no great anxieties and few cares—only the passing ones that attend the work of one who strives to

do with all his might whatsoever his hand findeth to do. He was

> Blessed with a temper whose unclouded ray
> Can make to-morrow cheerful as to-day.

This happy condition of mind was, no doubt, largely temperamental; it was based upon a calm and equable disposition that would have taken Fortune's buffets and rewards with equal thanks. That there were more rewards than buffets was due less to Fortune than to himself, for he was the architect of his own career, and used his opportunities wisely. It is true he started with advantages—a handsome presence, a well-knit, manly frame, a frank, ingenuous manner, good social connections, and, after his marriage, no anxieties as to the *res angusta domi.*

He was fond of the society of his fellows, hospitably disposed, and of a warm, genial nature. Indeed he had a genius for friendship, and a boundless capacity for sympathy and kindness—instinctive, spontaneous, impulsive—the sort of sympathy where action follows hard upon the heels of inclination, and the kind of kindness which is doubled because it acts quickly. Innumerable instances of his little nameless, but *not* unremembered acts of kindness and of love might be culled from a correspondence which stretches over half a century. But one characteristic action must suffice:

10 Bramham Gardens,
November 25, 1893.

I heard of you yesterday as having been out in a bath-chair—poor man!—so I came to two conclusions: (1) That you had been very ill. (2) That you were better. We have just come back from three hours at Woodcote, and I said, "I wish Thorpe was here." "Why not ask him and his wife to stay here next week?" said my

better-half. So this I now do, and I hope you will go there: the air is lovely: the house is warm. There is an old woman who can cook—and an old man who cannot. You could take one of your own maids to wait, and there is everything ready—beds and sitting-rooms, bread and meat—only no whisky.

I shall be delighted if you will both go there on Tuesday. There is Judy the pony and its cart at your service, and I can order a closed carriage to take you up.

You *must* take care of yourself. This attack ought to be and will be a warning to you not to work on as you have done. It is serious, and I am, with many friends, anxious you should draw in your horns. Really your professional work is enough for one man, and what a pile you put on to the top of this!

Let me know, if possible, to-morrow (Sunday) night whether you will go. I am sure you would enjoy yourselves, and I will let E—— know so that all shall be ready.

No man was more quick to recognize and to appreciate merit and worthy motives. Of strong common sense, perfectly sincere, frank and direct of speech, of an integrity of purpose which was perfectly obvious and which admitted of no unworthy compromise, he was, as they say in the quaint forceful Lancashire dialect he loved at times to recall as the speech of his forerunners, his eminent grandfather included—"jannock"[1] to the backbone—the very type we associate with the national character. These marks of his personality constituted the source of his influence. A broad-minded man, who thought spaciously and did things magnanimously, nature intended him to be a leader. His example was infectious, and nowhere was it more obvious than at Owens College, where the success of his own department was a constant stimulus to his colleagues.

[1] *Anglice:* "Fair, honest, straightforward, upright, genuine, square." Wright's "English Dialect Dictionary." Cf. Nodal and Milner's "Lancashire Glossary."

Men valued his counsel because they trusted his judgment.

He knew his limitations as a man of science. He was too honest and sincere to cherish any illusions as to the position posterity would assign to him as a leader in chemical inquiry. The profound respect, amounting almost to reverence, he had for Faraday, Joule, Bunsen, Helmholtz—all men he learned to know personally—was based upon the knowledge that they had reached intellectual heights to which he could not climb. He had not the studious, contemplative habit of his master Graham. Contact with Williamson kindled no latent faculty for speculation. The shibboleths of modern chemistry—types, bonds, linkages, chains, etc., etc., had hardly more real meaning for him than they had for Bunsen, to whom they were practically unintelligible. It was characteristic of both that when, at Kekulé's solicitation, they jointly attended the chemical congress on nomenclature at Carlsruhe in 1860, when Cannizzaro brought forward his memorable communication concerning the rational basis of fixing atomic and molecular weights, they should not have recognized its significance. Of course they were not singular in this respect. The revolution did not come at once. Avogadro's hypothesis never affected Bunsen's teaching; some years were needed before it reached Manchester, and there are still survivals who never have been clear why water should be HO one year and H_2O the next. Bunsen, indeed, used to say that one new chemical fact, even an unimportant one, accurately determined, was worth a whole congress of discussion of matters of theory.

The truth was Roscoe, in chemistry as in other matters, was primarily a man of action: he was essentially an "experimentarian philosopher," as Hobbes sneeringly dubbed the whole of the Fellows of the Royal Society. A fact absolutely ascertained was a definite and permanent addition to knowledge; hypotheses and theories were transitory and mutable; they have their day and cease to be.

But it would be unjust and untrue to assume that Roscoe set no value on theory: he fully recognized that she was the handmaid of Science. He who had so carefully studied Dalton's papers and followed the workings of his mind in the light of a century's experience, could not be unmindful of the worth of a fruitful conception. Mendelejeff's generalization when it was first promulgated at once attracted him, and he followed its startling verifications with the greatest interest. It was always a matter of gratification that his detection of the true relations of vanadium to the other elements, just prior to the announcement of the Law of Periodicity, should have removed at least what would have been one apparent exception to the universality of its truth.

When Roscoe first settled in Manchester he lived with his mother in the house which had been occupied by his predecessor, the late Sir Edward Frankland. On his marriage he moved to Victoria Park, and subsequently, after the birth of his children, to a larger residence which was built for him in the same neighbourhood. It was a charming, well-arranged house surrounded by a good-sized garden, and with an excellent tennis lawn, to which his colleagues and

senior students were freely invited on half-holidays during the summer months. In those days Roscoe was an active player, his reach and length of stride making him a formidable opponent. Both he and Lady Roscoe were fond of horses, and for some years riding in company with her was his usual form of outdoor exercise. Occasionally they would plan a driving tour together, and considerable sections of England and Wales were explored in this way. Whilst his children were young his long vacations were usually spent in the Lakes or in Scotland, or at Mr. Edmund Potter's country seat, Camfield Place, near Hatfield. Roscoe's long vacations usually meant to him either a change of occupation, or the continuance of a piece of literary work in new surroundings. Many of his memoirs were, in fact, put together during his vacations: it was only at such periods, when, free from the routine of lecturing, laboratory superintendence and College committees, that he could count upon the necessary freedom from interruption to arrange the results of an inquiry. The compilation of his smaller text-books was usually done at such times. The large treatise which he wrote with Schorlemmer, and which necessarily needed ready access to a library rich in serial publications, was mainly composed in Manchester. At one period of his career he was a frequent contributor to certain of the quarterly reviews, and the early volumes of *Nature* contain occasional communications from his pen. It was a point of honour to translate any paper of Bunsen's for the *Philosophical Magazine.*

During the earlier portion of his Parliamentary

career he lived in Mrs. Potter's town house in Queen's Gate, until he moved to Bramham Gardens, South Kensington, which continued to be his London house until a short time before his death.

Although he always regarded his thirty years at Owens as his chief work, the thirty years of his London life were hardly less busy than the time he spent in Manchester. The occupation might not be so continuous, but it was certainly more multifarious. Ten years of Parliamentary and active political life had brought with them new activities and fresh demands upon his time and energy, and except for occasional periods of enforced idleness due to attacks of gout—the only constitutional weakness from which he suffered, and which, as he used ruefully to observe, he had done nothing to deserve—he was always busy. He had a serious attack of pneumonia in the winter of 1902, which left him enfeebled for a time, but eventually, after a summer in Mürren and Burgenstock and a winter in Algiers and Sicily, he seemed to have completely shaken off its ill effects. Otherwise his sound and vigorous constitution kept him free from even passing ailments, and his fourscore years were passed with few interruptions to his activity from illness.

Shortly after Roscoe took up his residence in London he sought for some *pied-à-terre* in the country for the sake of rest and change of scene, and relief from the physical and mental strain of continuous life in town. In 1892 he was able to obtain a delightful place on Lord Lovelace's property in Surrey, some two dozen miles from London. It was beautifully situated on the North Downs, between

Guildford and Dorking, amidst some of the loveliest scenery in the South of England. He and Lady Roscoe altered it to suit their requirements: he to build a spacious study and to provide room for his many books, and she to house her own collection which was even more numerous, and to accommodate the many works of art with which she had surrounded herself. Roscoe has given a charming word-picture in his autobiography of this ideal retreat, to which as the years increased they became more and more attached. Here they had

> An elegant sufficiency, content,
> Retirement, rural quiet, friendship, books,
> Ease and alternate labour.

Here Lady Roscoe could indulge to the full her taste in gardening, and the cultivation of flowers and flowering shrubs became her main outdoor occupation. She worked at her hobby with all the enthusiasm and skill she had formerly displayed in photography, and with equal success, for she made Woodcote noted throughout the country-side for the choiceness and richness of its floral wealth. One who knew her well wrote of her:

> Flowers were named after her not so much as a criterion of her horticultural knowledge, as a recognition of an almost lavish generosity to the seedsmen and nursery gardeners, many of whom were her personal friends.

Attached to the property was a home-farm of some seventy acres, which had been allowed to get into a very backward state. Roscoe, with no previous experience of farming, resolved to bring it into better condition, and with the help of his Westmoreland

bailiff he gradually succeeded in doing so. The business was a constant interest to him. He was proud of his cart-horses which gained commendation and prizes at the local shows; of his well-bred Jersey cows; of his breed of Berkshire pigs—the little pigs were a constant source of amusement—and of his poultry. He records with much satisfaction that "our" field—(he always associated his bailiff with these agricultural triumphs, as he always associated his co-workers with his scientific achievements)—"our field of swedes on several occasions received the first prize for the best show twenty miles round Guildford." He went round his farm as he used to go round his laboratory, and seemed to be on the same genial terms with every animal on it as he had been with his students. The affectionate regard with which he used to contemplate an old sow—a most prolific creature by the way—was a source of much fun to his friends. If she did not wholly succeed in "paying the rint," she doubtless did her best towards it, and so merited and received commendation.

The hospitality of Woodcote is a treasured memory to numbers of Roscoe's friends. Few week-ends passed without one or more of them sharing its pleasures with him. Sometimes it would be one of his old associates in scientific work, or a political acquaintance, or a literary friend, or some distinguished man of science from abroad. Indeed, few foreign scientific men of any note passed through London without finding their way to Roscoe's hospitable board.

My father (says Miss Roscoe) delighted to bring foreigners, and the more heterogeneous they were the more he was pleased. I

remember one luncheon party of late years, consisting of a Chinaman, a Japanese, a Czech, a German, and our three selves, and the Occidentals were much the quietest of the party.

The visitors' book at Woodcote is a possession of no little historical interest.

In spite of their varied delights and restful charm there were times when Roscoe was not wholly content to breathe his native air in his own grounds: pigs, poultry, and potatoes, as he said, occasionally lost their spell, and "the pathetic sadness of a garden in autumn" would drive him and Lady Roscoe to a sunnier clime. Grasse, Italy, Egypt, Sicily, Algiers, Tunis, Biskra were in turn visited by them during different winters. Both he and his wife were fond of foreign travel, and well-written books of travel were a constant source of interest to her.

And so the evening of their lives drew to its close. Her end came swiftly—and with scarce a warning. His call was to come five years afterwards, and was to be no less sudden and equally unlooked for.

In the meantime came the War, with all its horrors, griefs, and anxieties — the crushed hopes for the Peace he had struggled to preserve so far as in him lay—the unending enmity and bitterness he foresaw between two nations that in his big heart he had fondly linked together as the mightiest humanizing forces of the world. It was a real grief to him that he should have lived to see it all. He frequently thought and spoke of his old Heidelberg friends — most of whom had passed away—and tried to realize their feeling of horror at the spectacle which now confronts us. But his

Germany was not the Germany of to-day, and gradually and reluctantly he was compelled to admit it. He still continued to occupy himself with his customary pursuits—so long as recurrent attacks of his arch-enemy the gout would permit. He read assiduously and took an active interest in current topics—the varying fortunes of the struggle, politics, and scientific matters. He preserved, in fact, all the interests of his life to the end. How mentally alert and vigorous he remained will be evident from the following letters:

WOODCOTE LODGE,
WEST HORSLEY, LEATHERHEAD,
September 20, 1914.

I have been laid up, more or less, since the war broke out with dyspepsia and gout, but now I am recovering. What are you doing, and when can we meet—which means when can you come here?

What do you say to Ostwald! I enclose a cutting from the *Westminster*—which please return, as I am going to book it for future reference. I agree with you that his swelled head is cracked.

What horrors! One can scarcely believe that the German, as you and I have known him, could have assumed such brutal characteristics as we read of. Here we are peaceful enough, but thirty young men, including Tom Huck, have gone from our village of 700 souls. Not bad!

Our crops are in—hay poor; oats ditto; wheat fair. Pigs in plenty, but no sale during the summer. I find on totting up that during ten years—some very bad—of farming my average loss has been £58 per annum, which I don't think is unsatisfactory, as I get quite that amount of value—beyond market price—in having good foodstuffs, and then pleasure in the processes and interest in the varying conditions, and in making things go in a bad situation for a farmer.

The war is not bad for the only commercial undertaking I have ever been connected with, for the demand for K, or rather NaCy, is great owing to the disappearance of the Continental supply, and the C. K. Co. are increasing the production to fill up the void.

Then I am again Chairman of the Lister, owing to B—— declining to have anything to do with a proposal to join the National Medical Research Committee—which the Governing Body suggest, and the question is to be settled in October by the vote of the members of the Lister Institute. So I am still awake, though lame and gouty.

Give my love to your wife, and let me hear from you. . . .

What is the name of the lame organic chemist who went from Heidelberg to the Badische?

WOODCOTE LODGE,
February 19, 1915.

. . . The Government have been bamboozled by a want of scientific acumen at the head—a not unusual occurrence *chez nous*. Thanks for sending me the report. . . . I am at last downstairs, and more or less in my right mind as well. So I feel better, but I do not suppose I shall be able to go up to town and mix with the gay world, as was my wont, until the March winds are over. A chill with me means six weeks indoors, if not something more serious.

What I need is to have some scientific gossip let loose at me, but you in your southern retirement are no use at all in that direction. Has your boat yet been requisitioned by the Admiralty, and if so, do you go out in charge, having, of course, previously joined the Navy?

We have here received notice to be prepared to drive off somewhere or other all our living animals, horses, cows, calves, pigs, and fowls! I scarcely know where I come in. Also I believe we are to destroy all our crops, gathered or not gathered—hay, potatoes, corn, and garden vegetables—so that the Hun may be an hungred! Also I propose to empty my large cellar of wine either down the drain or into the duck-pond, like Sir Wilfrid Lawson.

I await with anxiety the result of the R[oyal] S[ociety] election. If I were a betting man I should back G—— and M——, and perhaps my R—— ought to come in 15th. What about the 104 necessarily rejected candidates! Is it not absurd!

WOODCOTE LODGE,
September 21, 1915.

. . . My old friend Pattisson, our Treasurer at the Lister, is dead, and most of our men have joined the war in one or other capacity. So much lies on my shoulders, and though pretty broad, they are old, and I feel the responsibility of chairmanship.

He attended the meeting of the Lister Institute which has been referred to in one of his previous letters. The result disappointed him, but as it was not wholly unexpected, it but slightly, if at all, disturbed his usual philosophic calm. The death of his friend Rücker, the first Principal of the London University, a man whom he greatly respected and admired, which occurred on November 1st, was a far more serious blow, and affected him greatly.

He had retired to rest at his customary hour, in his usual serene and happy condition of mind and health, after spending a couple of hours in his daughter's society in the drawing-room reading or amusing himself, as was his wont, on the pianola with one of Beethoven's sonatas or some other classical piece. He had been thinking of his approaching birthday, and had suggested a little gathering of a chosen few of his old students whom he knew would be glad to celebrate it with him. But this was not to be. *Diis aliter visum.* Shortly after daybreak on the morning of December 18, 1915, he was seized with an attack of angina pectoris, and passed away with scarcely a struggle. With

> No cold gradations of decay,
> Death broke at once the vital chain,
> And freed his soul the nearest way.

What was mortal of him was laid to rest in Brookwood Cemetery in the grave which held the cherished partner of his life.

INDEX

Absorption of hydrochloric acid and ammonia in water, 121
Agassiz, Louis, 116
Alais meteorite, 132
Allerton Hall, 6
Arsenic-eating in Styria, 132
Atomic weights, Dalton's first table of, 132

Baines, Sir Edward, 61, 73
Bakerian Lectures, 114
Balmain, William H., 17
Barnes, Rev. Dr., 36
Baxendell, Joseph, 114
Bessemer process, application of spectroscope to, 133
Brühl, Professor, 140
Bryce, Lord, 43
Bunsen, R. W., his characteristics, 24, 26
Burning bush, 157

Carbon dioxide in sea air, 115
Carnegie, Mr. Andrew, 109
Carnegie Scholarships and Fellowships, 169
Cavendish, Lord Frederick, 55, 57, 61, 81
Chemical action of light, 110
"Chemistry Primer," 139
Chorley, Henry, his appreciation of Henry Roscoe, 14
Clarke, William, 4, 6
Clothworkers' Company of London, 57, 75, 88
Colonna, Vittoria, her life, by Maria Roscoe, 16
Columbium trichloride, 181
Conversation Club, Leeds, 55
Crompton, Mr. Justice, 20

Darwin, Sir George, 136
Darwin, Horace, 121
Debus, Dr. Heinrich, 142
Delafontaine, Philippe, 131
Deutsche Revue, 179
Devonshire, Duke of, 44, 61, 81, 82
Dittmar, Wilhelm, 27–35, 121
Draper (of New York), 110

Eclipse expedition to Sicily, 134
Enfield, Dr. William, 15
Ethyl perchlorate, 122
Eton College, 165

Fairbairn, Sir Andrew, 55
Fairfax, Henry, 46
Fairfax, Lord, 46
Faulkner, George, 29
Firth College, Sheffield, 167
Forster, W. E., 61, 66, 82
Frankland, Sir Edward, 128

Germany and England, 180
Gibson, John, sculptor, 6
Goldsmid, Sir Julian, 162

Index

Gott, Rev. Dr., Bishop of Truro, 73
Graham, Thomas, his characteristics as a lecturer, 19
Green, Prof. A. H., 59
Greenwood, Principal, 34, 44, 48, 50
Guthrie, Dr. Frederick, 35

Harden, Dr., 36, 141, 189
Heaton, Dr. J. D., 55, 57, 83, 86
Heddle, Professor (of St. Andrews), 126, 127
Heywood, James, F.R.S., 47
Heywood, Joseph, 101, 126

Irving, Washington, his appreciation of William Roscoe, 12

Jevons, Stanley, 20
"John Dalton and the Rise of Modern Chemistry," 141
Jones, H. L., his plan for University of Manchester, 47
Joule, James P., 37

Lead and thallium chlorides, vapour densities of, 131
Leeds Educational Council, 55
"Lessons in Elementary Chemistry," 138
Lister Institute of Preventive Medicine, 171
Liveing, Dr., first laboratory in Cambridge, 23
Lunt, Dr. Joseph, 139, 158
Lupton, Francis, 75

M'Creery, John, 6
Manchester University, early attempts to found, 45
Marshall, Prof. John, his appointment to the Yorkshire College, 74
Miall, Prof. Louis C., his appointment to Yorkshire College, 42
Morley, Viscount, of Blackburn, 109

"New View of Dalton's Atomic Theory," 141
Nussey, Arthur, plan for a Technical Institution for Leeds, 54
Nussey, George Henry, his plan for a Technical Institution for Leeds and District, 54
Nussey, Thomas, 53

Owens College, its origin, 28; its foundation, 30; its first professors, 31; its location, 31; its growth, 32; its extension, 41; new constitution, 42; its first attempt to include women, 43; erection of new buildings, 44; new chemical laboratories, 44
Owens, John, 28, 29
Owens, Owen, 28

Pankhurst, Dr. Richard Marsden, 91
Perchloric acid and its hydrates, 122
"Philippium," 131
Photochemical induction, 111
Photometric observations at Pará, 115; near Lisbon, 120
Playfair, Lord, 62; his address on technical education, 63, *et seq.*
Pulling, Prof. F. S., his appointment to the Yorkshire College, 74

Reform Bills, 1831–1832, drafted by Henry Roscoe, 13
Reid, Sir Wemyss, his support of the Yorkshire College, 68, 141
Ripon, Lord, 61, 66, 80, 82

Roscoe, Henry, his birth, 12; his characteristics, 12; becomes a barrister, 13; his legal works, 13; drafts Reform Bills of 1831–1832; his "Life of William Roscoe," 13; married Maria Fletcher, 15; becomes Judge of the Court of Passage, 14; his death, 14; appreciation of him by Henry Chorley, 14

Roscoe, Henry Enfield, his birth, 16; his education, 17; receives his first lessons in chemistry from William H. Balmain, 17; enters University College, London, 18; connection with Thomas Graham, 19; elects to follow chemistry as a career, 20; enters Birkbeck Laboratory, 21; his appreciation of Williamson, 21; becomes Williamson's assistant, 21; is offered an assayership in the Sydney Mint, 22; takes his degree in the University of London, 22; goes to Bunsen at Heidelberg, 23; in Heidelberg, 25; his first published paper, 25; makes his doctor examination, 25; memorial lecture on Bunsen, 25–26; studies German University system, 26; returns to London, 27; is appointed to Owens College, 27; his work at Owens, 34; his part in shaping the curriculum of the new University, 38; is elected Chairman of Convocation, 90; as a teacher, 97; is offered lectureship at St. Bartholomew's Hospital, 97; Chair at Oxford, 98; his method of working the Chemical Department at Owens, 98; his characteristics as a lecturer, 101; his portraits by Burgess and Herkomer, 103; address by students, 103; as an investigator, 110; gives his first Bakerian Lecture, 114; studies the absorption of hydrochloric acid and ammonia in water, 121; perchloric acid and its hydrates, 122; vanadium and its compounds, 123; gives his second Bakerian Lecture, 128; studies tungsten compounds, 130; discovers uranium pentachloride, 130; discovers columbium trichloride, 131; determines vapour densities of chlorides of lead and thallium, 131; disproves existence of "philippium," 131; maps spark spectrum of terbium, 131; redetermines the atomic weight of carbon, 131; lectures on spectrum analysis, 132; papers on spectrum analysis, 134; Sicilian eclipse expedition, 134; wreck of H.M.S. *Psyche*, 135; "Lessons in Elementary Chemistry," 138; "Chemistry Primer," 139; "Treatise on Chemistry," 139; "John Dalton and the Rise of Modern Chemistry," 141; "New View of Dalton's Atomic Theory," 141; writes his life and experiences, 144; is elected into the Royal Society, 146; is awarded a Royal Medal, 146; joins Chemical Society, 146; is President, 146; "Society of Chemical Industry," 147; receives medal of Society of Chemical Industry, 149; Honorary President of the International Congress of Applied Chemistry, 149; British

Association, 150; British Association President, 151; member of Royal Commissions, 152; is knighted, 154; enters Parliament, 154; political services, 155; chemical adviser to Metropolitan Board of Works, 157; becomes Vice-Chancellor London University, 162; Fellow of Eton College, 165; member of Scottish Universities Commission, 167; of Royal Commission of 1851 Exhibition, 168; examiner in the Science and Art Department, 170; Lister Institute, 171; dignities and honours, 175; member of Privy Council, 176; his jubilee, 177; the *Deutsche Revue*, 179; Germany and England, 180; home life, 190; characteristics, 191; Woodcote Lodge, 197; death, 203

Roscoe, Maria, her marriage, 15; her "Life of Vittoria Colonna," 16; her characteristics, 16; letter from, 39

Roscoe, William, his birth, 2; his schooling, 2; his love of literature, 2; becomes an attorney, 2; his poem "Mount Pleasant," 3; attacks the Slave Trade, 3; welcomes the French Revolution, 3; his studies of Italian literature, 4; his "Life of Lorenzo de' Medici," 4; his translation of Tansillo's "Nurse," 5; his "Life and Pontificate of Leo the Tenth," 5; purchases Allerton Hall, 6; reclamation of Chat Moss, 6; his connection with John M'Creery, 6; his protection of John Gibson, 6; his interest in botany, 7; founded Society for the Encouragement of the Arts of Painting and Design, in Liverpool, 7; Liverpool Academy, 7; Liverpool Literary and Philosophical Society, 7; Liverpool Lyceum, 8; Liverpool Atheneum, 8; Liverpool Botanic Garden, 8; Liverpool Royal Institution, 8; is elected member for Liverpool, 9; his share in the Abolition of the Slave Trade, 9; votes for Catholic Emancipation, 10; riots in Liverpool, 10; his Parliamentary work, 10; failure of Liverpool bank, 10; his monograph on the monandrian plants, 11; his edition of Pope's works, 11; his death, 12; appreciation of him by Washington Irving, 12

Royal Institution, lecture on amount of chemical light in tropics by Roscoe, 118

Rücker, Sir Arthur, 59, 81, 165

Sandbach, Mrs., 7

Schorlemmer, Carl, 35, 102, 121, 139

Schuster, Dr. Arthur, 131, 133

Science Lectures for the People, 38

Scott, Principal A. J., 33

Scottish Universities Commission, 167

Scudder, Frank, 159

Sherbrooke, Lord, 50

Spectrum analysis, 132

Spontaneous polymerization of volatile hydrocarbons, 101

Stewart, Dr. Balfour, 115

Technical Instruction Commission, 153

Terbium, spark spectrum of, 131

Index

Thallium perchlorate, 123
"The Life and Experiences of Sir Henry E. Roscoe," 144
Thompson, Joseph, his "History of Owens College," 29, 46, 48
Tithonometer, 111
"Treatise on Chemistry," 139
Tungsten pentabromide and pentachloride, 130

University College, Dundee, 167
University College, Liverpool, 167
University of London, 161
Uranium pentachloride, 130

Vanadium and its compounds, 123
Victoria University, 77; constitution as proposed by Manchester, 78; objections by Yorkshire, 80; joint memorial in favour of, 81; charter granted, 86; associates of Owens College the first graduates, 93

Walker Art Gallery, Liverpool, 11
Ward, Sir A. W., 48, 50, 81
Waterhouse, Alfred, R.A., 44, 75
Watts, Dr. W. Marshall, 133
Whatton, W. R., his plans for University of Manchester, 46
Williamson, Alexander, his characteristics, 21, 93
World Supremacy or War, 185
Wreck of H.M.S. *Psyche*, 135

Yorkshire Board of Education, 55
Yorkshire College, the, its origin and growth, 58, *et seq.*; report of Yorkshire Board of Education, 56; foundation of professorships, 58; its first premises, 59; its inauguration ceremony, 60; new college buildings, 75; Council considers question of foundation of Northern University, 76, 79

Printed in Great Britain by

UNWIN BROTHERS, LIMITED, THE GRESHAM PRESS, WOKING AND LONDON

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Digitized with financial assistance from

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